This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

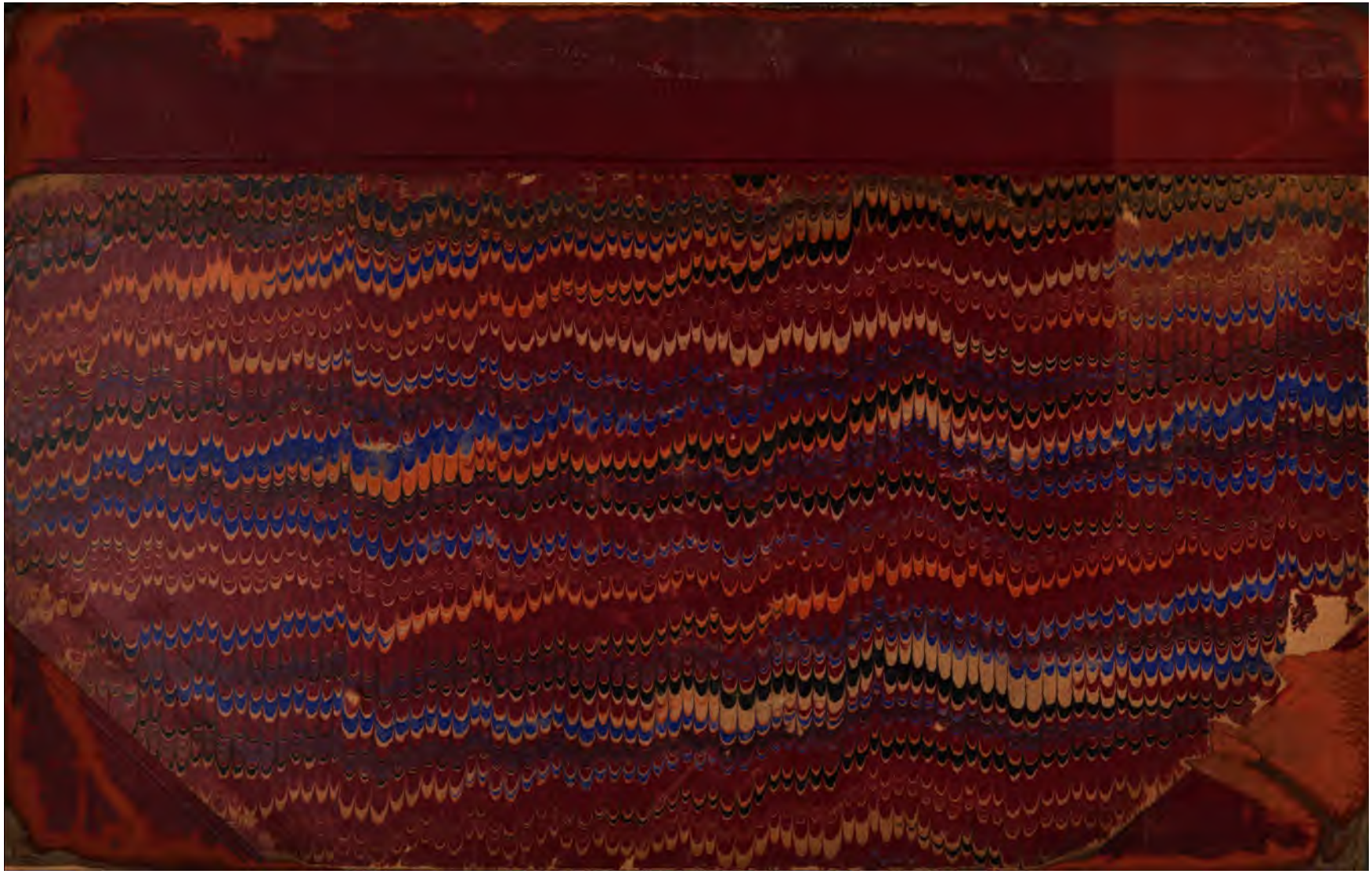
+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

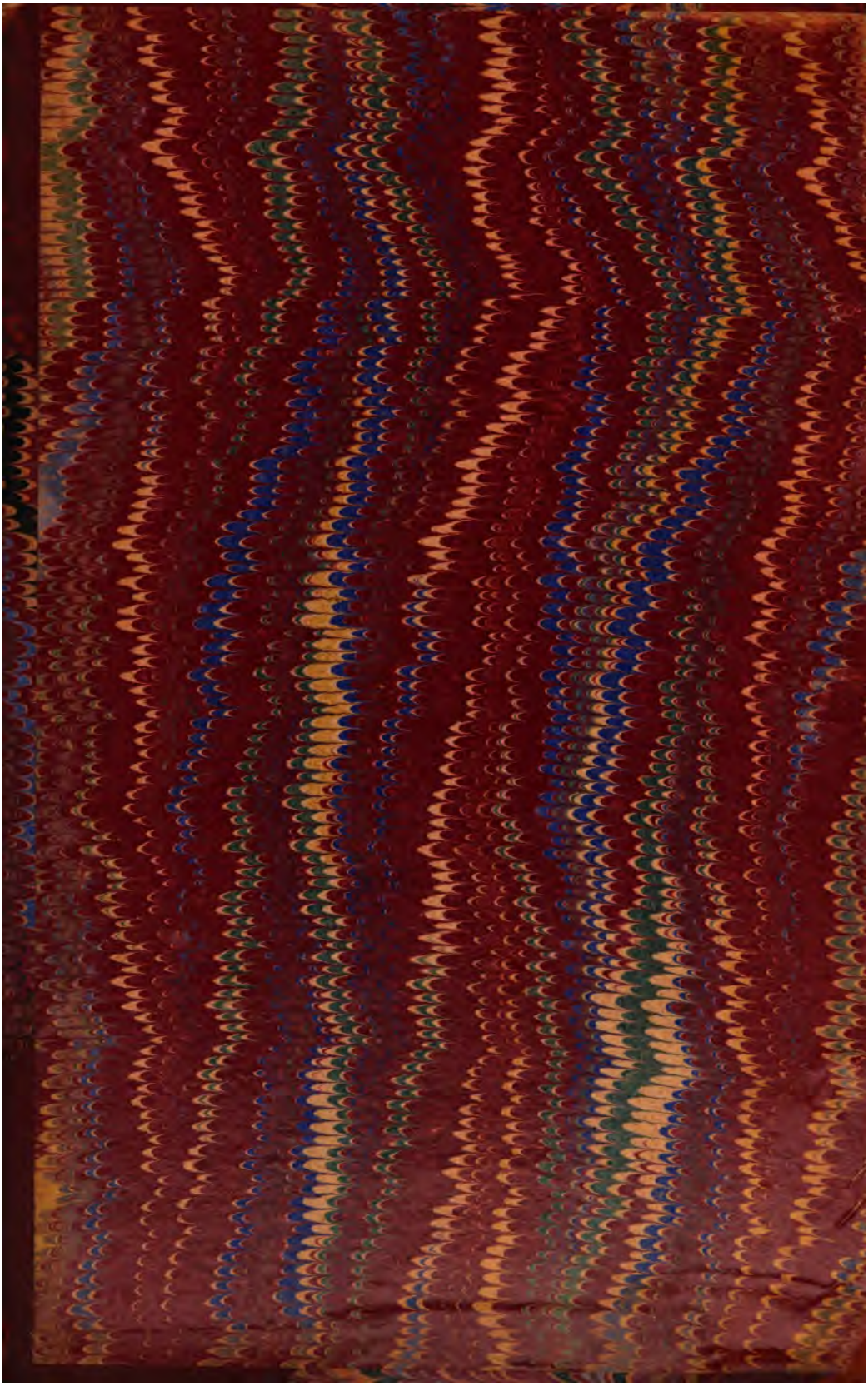
+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

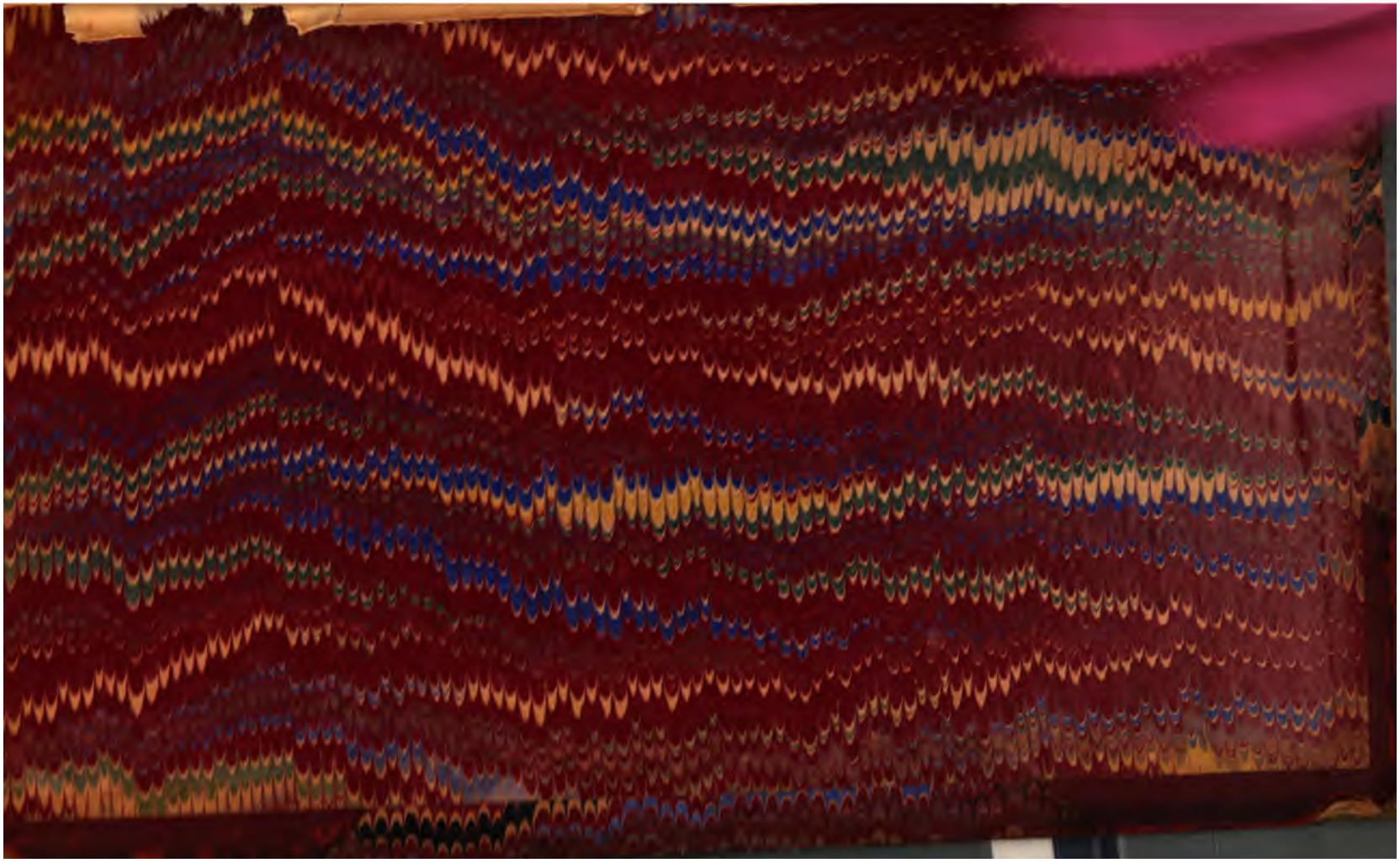
+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

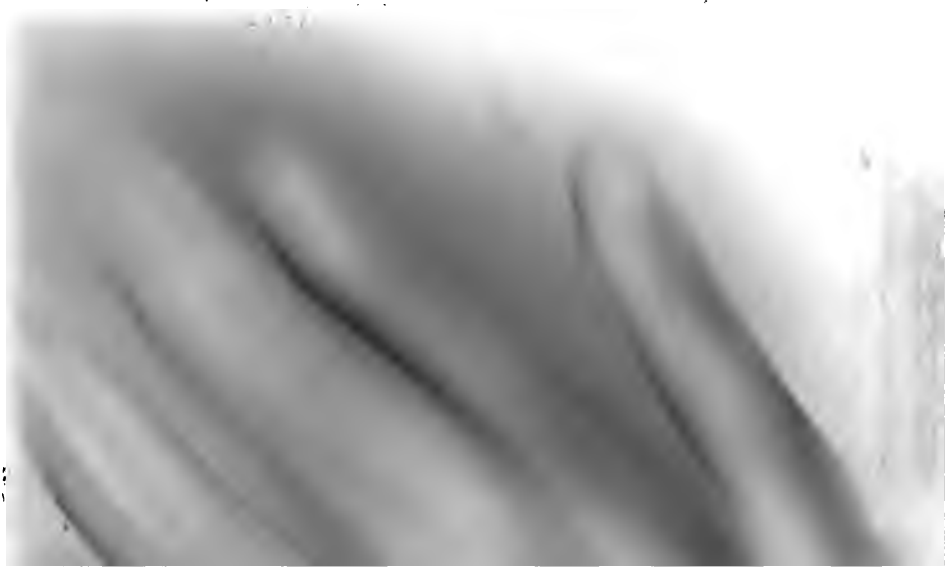
About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`









52D CONGRESS, 1st Session. } HOUSE OF REPRESENTATIVES. { EX. DOC. No. 12.

REPORT

OF

THE BOARD OF ORDNANCE AND FORTIFICATION.

JANUARY 5, 1892.—Referred to the Committee on Appropriations and ordered to be printed.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1892.

UF
23
.A23
1891

TABLE OF CONTENTS.

	Page.
Letter of transmittal	5
General report of Board	7
Index to general report of Board	31
Appendix A. Detailed statement of allotments and appropriations	35
Appendix B. Regulations for the inspection of guns and materials at all stages of manufacture	45
Appendix C. Circular letter giving details of tests, weights, and dimensions of contract guns to be furnished under act of September 22, 1888	58
Appendix D. Report of firings (resulting in bursting) of cast-iron B. L. mortar at Sandy Hook proving ground	61
Appendix E. Report of committee on high explosives of Board of Ordnance and Fortification	68
Appendix F. Report of Board of Ordnance and Fortification on "A site or sites for ordnance testing and proving ground"	83

WAR DEPARTMENT,
Washington, December 8, 1891.

SIR: In accordance with the requirements of the "act making appropriations for fortifications and other works of defense, for the armament thereof, for the procurement of heavy ordnance for trial and service, and for other purposes," approved February 24, 1891, I have the honor to transmit herewith for the information of Congress the report of the Board of Ordnance and Fortification, embracing the operations of the Board from its organization to October 30, 1891.

Very respectfully,

L. A. GRANT,
Acting Secretary of War.

The SPEAKER OF THE HOUSE OF REPRESENTATIVES.

REPORT OF THE BOARD OF ORDNANCE AND FORTIFICATION.

WASHINGTON, *October 24, 1891.*

The Hon. SECRETARY OF WAR:

The "act making appropriations for fortifications and other works of defense, for the armament thereof, for the procurement of heavy ordnance for trial and service, and for other purposes," approved February 24, 1891, contained the following provision:

Provided, That the Board of Ordnance and Fortification shall make an annual report to Congress, through the Secretary of War, on the first Monday in December in each year, showing the general operations of the Board, and shall give a detailed statement of all contracts, allotments and expenditures made by the Board, the first of these reports to cover these subject-matters from the beginning of the operations of the Board until the first report which they shall make.

Pursuant to the foregoing provision of law, the Board of Ordnance and Fortification herewith submits its first regular report, covering the first three years of its operations.

ORGANIZATION AND DUTIES OF THE BOARD.

The Board of Ordnance and Fortification was created by the act of September 22, 1888, being the same act which initiated the new project of seacoast defenses and the Army gun factory at Watervliet Arsenal, New York.

The first section of that act provided—

That the appropriation hereinafter provided for shall be available until expended, and shall be expended under the direct supervision of a Board to consist of the Commanding General of the Army, an officer of Engineers, an officer of Ordnance and an officer of Artillery, to be selected by the Secretary of War, to be called and known as the Board of Ordnance and Fortification; and the said Board shall be under the direction of the Secretary of War, and subject to his supervision and control in all respects, and shall have power to provide suitable regulations for the inspection of guns and materials at all stages of manufacture, to the extent necessary to protect fully the interests of the United States, and generally to provide such regulations concerning matters within said Board's operations as shall be necessary to carry out to the best advantage all duties committed to its charge: *Provided*, That, subject to the foregoing provisions, the expenditure shall be made by the several bureaus of the War Department having jurisdiction of the same under existing law.

This statute created the Board and established its general jurisdiction.

Other provisions of law have from time to time enlarged or narrowed the scope of the operations of the Board in special matters, to be hereinafter referred to, but this general jurisdiction has remained substantially unchanged.

Pursuant to this statute the following designations for the Board were made and promulgated by the Secretary of War, to wit:

Special Orders, No. 249.

HEADQUARTERS OF THE ARMY,
ADJUTANT-GENERAL'S OFFICE,
Washington, October 25, 1888.

[Extract.]

* * * * * * * *

7. The following order has been received from the War Department:

WAR DEPARTMENT,
Washington City, October 25, 1888.

Under a provision of an act of Congress entitled "An act making appropriations for fortifications and other works of defense, and for the armament thereof, for the procurement of heavy ordnance for trial and service, and for other purposes," approved September 22, 1888, a Board, to consist of the officers hereinafter named, "to be called and known as the Board of Ordnance and Fortification," and to "be under the direction of the Secretary of War and subject to his supervision and control in all respects," is hereby appointed "to provide suitable regulations for the inspection of guns and materials at all stages of manufacture to the extent necessary to protect fully the interests of the United States, and generally to provide such regulations concerning matters within said Board's operations as shall be necessary to carry out to the best advantage all duties committed to its charge."

Maj. Gen. John M. Schofield, U. S. Army.
Col. Henry L. Abbot, Corps of Engineers.
Col. Henry W. Closson, Fourth Artillery.
Lieut. Col. Alfred Mordecai, Ordnance Department.
Capt. Charles C. Morrison, Ordnance Department, is detailed as recorder of the Board.

WM. C. ENDICOTT,
Secretary of War.

* * * * * * * *

By command of Maj. Gen. SCHOFIELD,

R. C. DRUM,
Adjutant-General.

The Board as thus constituted met and organized October 30, 1888. These designations for members of the Board have remained unchanged to the present time, but Capt. Charles C. Morrison, Ordnance Department, was relieved as recorder of the Board, and Capt. D. M. Taylor, Ordnance Department, was detailed in his place, Capt. Taylor assuming his duties January 14, 1890.

By the fortification act of February 24, 1891, provision was made for an increase of the Board as follows:

And one additional member shall be added to the Board of Ordnance and Fortification, who shall be a civilian and not an ex-officer of the Regular Army or Navy, and he shall be nominated by the President, and by and with the advice and consent of the Senate appointed, and he shall be paid a salary of five thousand dollars per annum and actual travelling expenses when travelling on duty.

In accordance with this law the President on the first day of July, 1891, appointed Hon. Byron M. Cutcheon, of Michigan, as such civilian member of the Board, who duly qualified and entered at once upon the performance of his duties as such.

THE JURISDICTION OF THE BOARD.

The act before recited requires the Board to make a report (1) showing "the general operations of the Board," and (2) to "give a detailed statement of all contracts, allotments, and expenditures made by the Board."

It will be observed that according to the organic act (September 22, 1888) the Board is to be "under the direction of the Secretary of War and subject to his supervision and control in all respects," upon the one hand, and that "subject to the foregoing provisions the expendi-

ture shall be made by the several bureaus of the War Department having jurisdiction of the same, under existing law," upon the other hand.

The Board is thus only advisory to the Secretary of War, and itself makes no contracts and expends no appropriation except for the necessary expenses of the Board.

So far as contracts and expenditure of appropriations are concerned its functions are to make recommendations to the Secretary of War.

In the matter of allotments its recommendations are advisory only, and may be approved or disapproved by him.

By the acts of 1888 and 1889 the appropriation for fortification and armament is placed "under the direct supervision of the Board of Ordnance and Fortification." Under the acts of 1890 and 1891 that part of the appropriation which relates to armament of fortifications is placed under such supervision, and by the act of 1890, the appropriation for gun and mortar batteries and for the procurement of land for sites, also is so placed.

With this statement it will be understood when it is said that it is impossible to report "contracts made by the Board," inasmuch as no contracts have been made by it.

In order, however, to afford as far as possible the information desired, the Board incorporates herewith a detailed statement, showing all appropriations made (beginning with that of September 22, 1888), subject to the supervision of the Board, also a detailed statement showing all allotments made or recommended by the Board from such appropriations. For convenience of reference these two statements are combined, and are made Appendix A. A detailed statement is also appended showing all expenditures made by the Board.

From these several statements it will be seen that the total amount appropriated subject to the supervision of the Board to date has been $11,385,332; and in addition thereto the sum of $3,500,000 will be required to fulfill the contract with the Bethlehem Iron Company, approved by this Board, which will need to be estimated and appropriated from year to year, as the contract progresses.

The total amount allotted by the Board has been $10,526,625.26.

And the entire amount expended by the Board for its expenses to the date of this report has been $5,567.50.

GENERAL OPERATIONS.

Under the head of "General Operations of the Board" a vast number of subjects have come before it, embracing almost every possible form of project for fortifications and armament.

To all of these the Board has given careful and conscientious attention, though the greater number have been such as could not be adopted or recommended. There is one hopeful and favorable feature, however, in all this, and that is that it shows the great and widespread interest and activity in the matter of national defense.

To specify the action taken on them all would be to transcribe the proceedings of the Board, which fill several volumes. It will suffice to state briefly the action taken upon each of the most important elements of fortification and armament which have been considered.

ARMY GUN FACTORY.

One of the most important and interesting steps in the progress of the new policy of seacoast defense inaugurated by the act of Septem-

ber 22, 1888, is the installation of the Army gun factory at Watervliet Arsenal, West Troy, N. Y. In fact it may be said to have been the initial step in that policy.

The act above named provided—

For the erection, purchase, or manufacture of the necessary buildings and other structures, machinery, tools, and fixtures for an Army gun factory for finishing and assembling heavy ordnance, to be erected at the Watervliet Arsenal, West Troy, New York, seven hundred thousand dollars.

This amount became at once available; the Board on November 6, 1888, allotted the full amount for the purpose intended, based upon plans for the factory, which had already been prepared by the Ordnance Department and submitted to the Board, so that by December, 1888, it became possible to let some of the contracts for construction and to begin work.

For details of the progress of construction reference is made to the annual reports of the Chief of Ordnance for 1889 and 1890, under which Department the work has been done.

In about two years from the making of the appropriation the north wing of the factory was so far completed as to be occupied for its intended use, with the machinery, except the heaviest, in place.

By September 30, 1890, the whole amount of the original appropriation of $700,000 had been expended or obligated by contracts.

By the act of August 18, 1890, a further sum of $526,300 was appropriated for the completion and equipment of the factory, of which $165,000 was "for machinery to complete to full capacity the present gun-factory building," and $320,000 was "for boring and turning-lathes, rifling machine, and 80-ton traveling crane, fully equipped for the manufacture of 12-inch guns," and the remainder was for miscellaneous purposes.

This appropriation was apportioned by act of Congress to the special purposes for which it was intended, and required only the formal action of the Board. This allotment was promptly made. So far as it has been expended it has been done through the Ordnance Department having jurisdiction of the same.

By the act of February 24, 1891, provision is made for the erection and equipment of the south wing of the gun factory; $248,743 being appropriated for the building, including ways for traveling crane, and $268,000 for machinery, tools, power plant and fixtures.

The Board has not visited the work since this appropriation was allotted, but is informed that good progress has been made with the building, and that contracts for its equipment are progressing satisfactorily.

Other appropriations, amounting to $29,500, for completing the equipment of the gun factory, were made by the act of 1891, making the total amount appropriated for that object to date $1,772,543, without taking into account the value of the site.

The entire amount has been alloted, as shown by the following statement:

Allotments for Army gun factory.

ACT SEPTEMBER 22, 1888.

'ings, machinery, tools and fixtures.....	$680,000
ion and completion of two sets of officers' quarters.....	20,000

FORTIFICATION ACT, AUGUST 18, 1890.

1890.			
Sept.	2.	For machinery to complete building to full capacity	$165,000
Oct.	1.	For building for wash room, closets, etc.	12,000
	4.	Fireproof brick office building (not approved until September, 1891)	23,000
Sept.	2.	Railroad sidings, etc., and weighing scale	2,800
		Engine and shafting	3,500
		Boring and turning-lathes, rifling machine, and 80-ton crane	320,000

FORTIFICATION ACT, FEBRUARY 24, 1891.

1891.			
Mar.	25.	To complete erection of south wing	248,743
		For machinery, etc., for south wing	268,000
		Shrinkage pit, etc.	14,000
		Locomotive and cars	9,000
		Wharf repairs, etc.	6,500
		Total	1,772,543

These figures relate to the new gun factory for the fabrication of sea-coast guns of heavy caliber. In addition to the allotments for the new gun factory the Board has been called upon to make and has made the following allotments to complete the equipment of the old (or small) gun shop at Watervliet, which is engaged in the fabrication of field and siege guns, projectiles and experimental guns, to wit:

Dec. 4, 1889, for making alteration in machinery and for purchase of new machines for experimental guns	$13,888
Oct. 1, 1890, for increase of machinery and plant for manufacture of projectiles and for castings	16,000
Total	29,888

The factory is now turning out guns up to and including 12 inches caliber. The 8-inch gun, the only one which has been fully tested, has proved itself satisfactory.

When completed, as contemplated by the act of 1891, the factory will be equipped for manufacturing all calibers up to and including 12 inches, and the building will be adapted to receive machinery for finishing and assembling 16-inch guns, should Congress hereafter authorize their construction.

The Board has carefully considered this question of additional machinery, and is strongly of opinion and now recommends that it should be of a size adapted to finish and assemble the 16-inch gun. If designed for calibers of only 12 inches or less, it will be unable to work upon guns of a larger size, while if designed for the 16-inch gun it will be entirely serviceable for smaller calibers. If the vacant space in the factory be filled with these smaller tools, much loss of time and needless expense will be incurred in removing and replacing them when Congress elects to commence the manufacture of a larger type. That a larger type than the 12-inch gun is necessary for our coast batteries is certain. No one proposes to reduce the heaviest naval guns below 13.5 inches in caliber, and nothing can be more certain than that land batteries should be equipped with guns of higher power than those to be brought against them. The difficulties of limited flotation, restricted space and excessive weight of armor do not apply to guns mounted [illegible] the solid earth. The mere fact that the English 16-inch guns now [illegible] pear to have insufficient strength, should not condemn the entire cl[illegible]

Whether that last caliber, or one somewhat smaller, should be selected, and what should be the special type of construction adopted, are questions which may be left unsettled for the present; but in purchasing tools which require years for their fabrication they should be made large enough to meet all the requirements likely to be thrown upon them.

STEEL FORGINGS FOR GUNS.

One of the largest single appropriations which has come under the jurisdiction of the Board, is that contained in section 4 of the act of September 22, 1888, "For the purchase of rough-finished, oil-tempered, and annealed steel for high-power coast defense guns of 8, 10, and 12 inch caliber, $1,500,000."

It devolved upon the Board to prescribe the inspections and tests under which such forgings should be made, and which should become a part of the contracts therefor.

Elaborate "regulations for the inspection of guns and materials at all stages of manufacture to the extent necessary to protect fully the interests of the United States" were formulated by the Ordnance Department and submitted to the Board for its approval.

The Board, after careful and detailed consideration of the proposed regulations, inspections and tests, on November 6, 1888, approved the same, and these inspections and tests are applied to all steel to be used in the construction of any portion of a steel gun or mortar made under the supervision of the Board. A copy is hereto appended marked B.

Usually from two to four test specimens of steel are taken from each end of every tube, jacket, hoop or trunnion band, each piece duly marked so as to denote the location from which it is taken, and subjected to vigorous tests before it is accepted or permitted to be used. These tests are all recorded and reported to the Ordnance Bureau. For an ordinary 10-inch gun not less than sixty-three test specimens are required, and for a 12-inch gun a larger number.

On January 31, 1889, the contract for these forgings was let to the Bethlehem Iron Company for twenty-three sets for 8-inch guns, twenty-three sets for 10-inch guns, and fifteen sets for 12-inch guns, at a total cost of $1,461,982.

This contract is now in course of fulfillment and must be completed, under penalty, by December 1, 1893.

The cost of these forgings is 27⅛ cents per pound for 8-inch guns, and 30½ cents per pound for 10 and 12-inch guns. It is upon these forgings that the Army Gun Factory is now at work.

In anticipation that the forgings procured under the act of 1888 will have been finished and assembled by the close of 1893, an additional appropriation of $800,000 was made by the act of February 24, 1891, for the same purpose, and the contract therefor has been let to the Midvale Steel Company of Philadelphia, that company being the lowest bidder.*

The contract with the Midvale Company is expected to produce 12 8-inch, 12 10-inch and 9 12-inch sets of forgings.

* These forgings are entirely apart from and in addition to the one hundred guns to be completed under the contract of the Bethlehem Iron Company, for which that company will furnish its own forgings.

It will be seen, therefore, that provision has already been made for the following enumerated forgings for heavy guns:

	8-inch.	10-inch.	12-inch.
	Sets.	*Sets.*	*Sets.*
Act 1888	23	23	15
Act 1891	12	12	9
Contract guns (1890)	25	50	25
Total	60	85	49

The total number of guns required under the approved project of fortifications (report of the Board of Fortifications and other Defenses, 1886) will be as follows: 102 8-inch, 222 10-inch, 203 12-inch, thus leaving 42 8-inch, 137 10-inch and 154 12-inch to be provided for.

In addition to these, the project calls for 44 16-inch and 6 14-inch guns, for which no appropriation or provision has yet been made; also for 24 10-inch and 700 12-inch seacoast mortars, for 73 only of which provision has been made. Carriages are yet to be provided for substantially all, both guns and mortars.

The following table will show the allotments which have been made for gun forgings of all calibers to date:

Allotments for forgings.

ACT SEPTEMBER 22, 1888.

Nov. 6, 1888.	Steel for forgings for 8, 10 and 12 inch guns	$1,500,000
Dec. 13, 1888.	Drawings and forgings for 3.2-inch gun, to be fitted with Driggs' breech mechanism, including small tools	2,857

ARMY APPROPRIATION ACT MARCH 2, 1889.

May 2, 1890.	Steel forgings, 10 5-inch siege guns	20,000
Oct. 1, 1890.	Steel forgings, 10 7-inch howitzers	18,000
Mar. 26, 1891.	Steel forgings, 16 3.6-inch field guns	2,000

ACT FEBRUARY 24, 1891.

Mar. 25, 1891.	Steel for high power guns	800,000
	Total	2,342,857

CONTRACT GUNS.

The fortification act of September 22, 1888, provided for contract guns in the following manner, viz.:

Whenever any party shall present for test a completed single-charge breech-loading steel gun of ten or twelve inches caliber, and of weight and dimensions to be prescribed by the Board with the proper supply of ammunition for the test of the same, such gun shall, in the presence of the party presenting it, be subjected to such tests as the Board shall have prescribed; and should such gun be shown to the satisfaction of the Board by such tests to fulfill the requirements previously prescribed in respect to accuracy, range, power, endurance, and general efficiency, the gun and ammunition shall be paid for at a fair valuation, including cost of transportation, and contract shall be made at a price reasonable in the opinion of the Board, with the party presenting the best of such guns, for a further supply of similar guns, to be subjected to the usual service test before acceptance, the experimental gun and all guns purchased hereunder to be subject to inspection at each stage of manufacture, as follows, namely: For not less than fifty ten-inch steel guns; and for not less than fifty twelve-inch steel guns.

The Board on January 11, 1889, after careful consideration of the subject, prescribed tests weights and dimensions, as required by the provisions of the law for any guns which may be presented under this section, and, although the law did not require bids to be invited, prepared a circular letter (copy of which is appended, marked C), which was extensively circulated among such persons as were thought to be likely to present guns for test. Up to the present time no proposition has been received from any party to construct a gun under this act.

Hundred gun contract.—The fortification act of August 18, 1890, contained the following provision:

SEC. 2. That the Secretary of War is hereby authorized and directed to purchase under contract, after due advertisement inviting proposals, and at prices which the Board of Ordnance and Fortification shall adjudge to be fair to the manufacturer and for the interest of the United States, twenty-five eight-inch, fifty ten-inch, and twenty-five twelve-inch guns, all of which guns shall be breech-loading single-charge steel guns, and of weight and dimensions to be prescribed by the Board, and shall fulfill the condititions hereinafter provided: *Provided,* That if two or more persons, citizens of the United States, submit proposals to furnish said guns, either in part or in whole, at prices not materially different from each other, contracts may be awarded, in such proportion, among the citizens submitting such proposals as the Secretary of War may direct. One type gun of each of the above-mentioned caliber, with the proper supply of ammunition therefor, shall be presented for test at such place and within such time as the contract shall provide, and shall be subjected to such tests in respect to accuracy, range, power, endurance, and general efficiency as the Board of Ordnance and Fortification shall have prescribed. All the other guns of each caliber, with the proper supply of ammunition, shall be delivered at such place and within such times as the contract shall provide, and shall be subjected to the ordinary service test of ten rounds with the full charge and weight of projectile, which shall develop the standard power prescribed for the gun. If the type gun sustains the prescribed test to the satisfaction of the Board of Ordnance and Fortification, it and each of the other guns which sustains the ordinary service test, and the ammunition expended in such tests, shall be accepted under the contract. All guns manufactured under these contracts, including the type guns, shall be subjected to inspection at all stages of manufacture, and no change whatever shall be made in the material, mode of manufacture, or dimensions of the guns for service from those employed in the type gun without the approval of the Secretary of War. Payment for each gun and ammunition for testing same, including cost of transportation, shall be made upon the satisfactory completion of the prescribed test for that gun. All tests of guns shall be made in the presence of the Board and of the person presenting the gun, or his authorized agent, and due regard shall be paid to suggestions offered by him which respect the mode of making such test.

That under the provisions of this section there shall not be expended or contract or contracts entered into involving the Government in an aggregate expenditure exceeding three million seven hundred and seventy-five thousand dollars, nor an expenditure on the part of the Government in any one fiscal year in excess of one million dollars. And all guns and materials purchased under the authority of this section shall be of American manufacture and furnished by citizens of the United States.

In regard to this provision of the law it may be observed: First, that all guns and materials purchased under the authority of this section must be of American material and manufacture, and furnished by citizens of the United States; second, it calls for the purchase of the finished and completed guns from forgings to be furnished by the contracting parties; and third, that the contractor is not confined to any particular type of gun, so long as they are breech-loading, single-charge, steel guns. They are required to be of weight and dimensions prescribed by the Board of Ordnance and Fortification, and to be subjected to such tests as that Board shall have prescribed.

The obvious purpose of this legislation seemed to the Board to be: First, to encourage and induce the establishment of at least one gun plant in the United States, in addition to the Government factories, capable of turning out 8, 10, and 12-inch steel guns by American labor and skill, from American materials; and second, to encourage and give opportunity to American inventive and mechanical genius, to bring for-

ward new types of guns, subject to tests to be prescribed, to compete with the adopted Ordnance Department type of gun now being produced.

In this connection three functions were devolved upon the Board of Ordnance and Fortification: the first, to prescribe the weight and dimensions of the several calibers of guns; the second, to adjudge whether the prices proposed were "fair to the manufacturer and for the interests of the United States;" and the third, to prescribe and supervise the proper tests of the type guns which should be produced and offered.

On October 8, 1890, proposals were invited for furnishing these hundred guns under contract, in accordance with the foregoing act; but although until December 18 was allowed for opening the proposals, none were received, manufacturers appearing to be unprepared to make bids, doubtless on account of the costly nature of the plant required, and, perhaps, on account of the amount of the appropriation being limited to $3,775,000.

By the fortification act approved February 24, 1891, the limit of expenditure was increased to $4,250,000, $50,000 being "reserved to cover all expenses other than powder and projectiles incident to the tests and inspection of the guns;" and also the Secretary of War was "authorized to contract thereunder for such less number of guns than one hundred as he may deem for the best interests of the Government."

After this supplemental legislation the Department again, on May 8, 1891, advertised for proposals for the 25 8-inch, 50 10-inch and 25 12-inch guns.

Bids having been opened on July 13, 1891, it was found that proposals had been submitted by three parties: The Midvale Steel Company, of Pennsylvania; the South Boston Iron Works, of Boston, Mass.; and the Bethlehem Iron Company, of Bethlehem, Pa.

These proposals were submitted to the Board to adjudge whether the prices proposed were "fair to the manufacturers and for the interest of the United States."

It was found that the proposals of the Bethlehem Iron Company were so far below those of their competitors, that they were practically the only ones before the Board for consideration. After elaborate hearings both of the officers of the company and of the representatives of the Ordnance Department, and after most careful deliberation, the Board arrived at the following conclusions, to-wit:

The Board is of opinion:

(1) That the interest of the United States does not require that guns should be turned out at a rate materially greater than carriages and emplacements can be provided, suitable appropriations therefor being made to make them available for use.

(2) That the interest of the United States does not require that guns should be procured by contract to the displacement of the plant and skilled labor already provided for at the Army gun factory at Watervliet.

(3) That considering the necessary appropriations for maintenance and operation of the gun factory, for additional forgings to keep it in operation, for carriages and emplacements, for mortars and carriages therefor, and other necessary objects of defense and armament, it is not for the interest of the United States to hasten the contract guns to a degree likely to cripple appropriations for these other necessary objects.

(4) That it is for the interest of the United States to accept that bid of the Bethlehem works which, conformably with the foregoing propositions, will secure the establishment of a private gun plant within a reasonable period, with the least cost for plant to the United States.

(5) That Schedule E, in the opinion of the Board, is the schedule which most nearly conforms to these conditions. The Board, therefore, in conformity with the duty imposed on it by the fortification acts approved August 18, 1890, and February 24, 1891, adjudges the prices named in the proposals of the Bethlehem Iron Company of July 11, 1891, under Schedule E, to be fair to the manufacturer and for the interest of the United States.

The Board recommends that a contract be entered into with the Bethlehem Iron Company for the manufacture of 100 breech-loading single-charge built-up forged-steel rifled guns, under Schedule E of its proposal of July 11, 1891, viz., 25 8-inch breech-loading rifles each for $17,246.55, including ten rounds of ammunition complete; the first gun manufactured to be the type gun, which shall be subjected to such tests as the Board of Ordnance and Fortification shall hereafter prescribe; that the ammunition required for these tests over and above the ten rounds supplied with the gun shall be furnished by the company at the price of $71.09 per round; 50 10-inch breech-loading rifles, each for $35,747.58, including ten rounds of ammunition complete; the first gun manufactured to be the type gun, which shall be subjected to such tests as the Board of Ordnance and Fortification shall hereafter prescribe; that the ammunition required for these tests over and above the ten rounds supplied with the gun shall be furnished by the company at the price of $131.06 per round; 25 12-inch breech-loading rifles, each for $54,473.22, including ten rounds of ammunition complete; the first gun manufactured to be the type gun, which shall be subjected to such tests as the Board of Ordnance and Fortification shall hereafter prescribe; that the ammunition required for these tests over and above the ten rounds supplied with the gun shall be furnished by the company at the price of $217.06 per round.

The Bethlehem Iron Company before the contract is made should submit for the approval of the Board of Ordnance and Fortification detailed drawings of each caliber of gun contemplated under its proposal of the 11th of July, 1891. The physical qualities of the metal, the tests to be made of it, and all details of assembling the parts and all points relating to the construction of the guns required to carry out the proposals of the company, should be approved by the Chief of Ordnance before being submitted to the Board.

The Board is further of opinion that the Chief of Ordnance should be authorized to make agreement with the contractor so as to admit of such changes being made, from time to time, in the guns to be furnished as may be necessary to keep abreast of any improvements that may hereafter be attained in gun construction.

To fully understand the foregoing action of the Board it should be stated that the Bethlehem Iron Company submitted five distinct proposals, with prices dependent on the time of the delivery of the guns; the highest price being related to the shortest time of delivery and depending upon the magnitude of the plant required and the consequent greater cost of production.

The length of time required for the production and delivery of the one hundred guns, including the time required for erection of plant and construction and test of type gun, under the lowest bid, is estimated at eleven years and nine months. But as the company has signified its purpose of adopting the Ordnance Department standard type gun, already completed and in part tested, it is believed that a less time will be sufficient.

As will be seen the Board has recommended the acceptance of the lowest bid and longest time, which will distribute the cost of the guns over at least ten years, and require no large appropriation in any one year.

The great desideratum, however, provided by this legislation, as understood by the Board, is to secure the establishment in the United States of an independent gun plant, capable of producing finished guns of heavy caliber, which, in case of emergency, may be employed to supplement the Government gun factories in the armament of our fortifications.

Another consideration which had much weight was that it would permit the Army gun factory to be turned to other not less necessary gun work, and thus expedite by several years the completion of the defense of our principal seaports.

It also devolved upon the Board to prescribe the weight, dimensions, inspections, physical properties and tests of such guns as should be offered, which duty the Board performed, and these specifications were embodied with the instructions to bidders, and became incorporated in every bid made.

The following are the conditions prescribed by the Board as those to which the 8, 10 and 12-inch single-charge steel breech-loading guns to be procured under section 2 of the fortification act, approved August 18, 1890, and the fortification act, approved February 24, 1891, must conform, viz.:

FOR A GUN OF 8-INCH CALIBER.

The weight shall be about 14½ tons (long).

The length of bore shall be 32 calibers, measured from the face of the obturator to the face of the muzzle of the gun. (In order that the gun may not require a special carriage for its proof, it is desirable that the diameter of the trunnions be 10 inches, and the distance between rimbases 32.5 inches.)

The power shall be such as may be expressed by a muzzle energy of not less than 7,600 foot-tons.

The range shall for 20 degrees elevation be about 11,000 yards, and corresponding ranges shall be obtained with lower elevations.

The standard of accuracy shall be as given in the following table, and shall be approximately attained:

Table of accuracy—25 per cent rectangles.

Range.	Vertical rectangle.		Horizontal rectangle.	
	Height.	Width.	Length.	Width.
Yards.	*Feet.*	*Feet.*	*Yards.*	*Yards.*
1,500	1.4	1.0	.....	.....
3,000	3.4	2.9	.....	.....
6,000	.....	.....	29.7	4.2
8,000	.....	.....	38.9	6.7
10,000	.....	.....	48.5	9.2

The endurance test should not be less than 350 rounds with full charges. After 300 or more rounds may have been fired, the gun may be lined wholly or in part, when at least 50 rounds more will be fired to fully test the strength of the construction. After this, the general soundness and efficiency of the gun should not be materially impaired, except that a reasonable amount of erosion will be admitted. Should any material modification of the construction be made during the trial, at least 50 rounds, with full charges, shall be fired thereafter.

The weight of projectile to be used with full charge shall be about 300 pounds. Three hundred and fifty rounds of ammunition shall be the proper amount to be supplied with the gun for test.

As a proof of general efficiency the breech mechanism should work freely and be convenient for operating, the opening and closing of the breech to be performed without great difficulty by one man. The projectiles shall admit of being readily handled, inserted, and centered in the bore, and not be subject to injury or deformation either in handling or transportation.

A rapidity of fire of 20 rounds per hour shall be attainable, using such appliances for loading as are employed by the Ordnance Department, U. S. Army.

The repairs allowable during the entire trial of a gun, exclusive of the insertion of a lining tube, will be confined to repairing or renewing parts injured during trial. No alterations that may affect the general construction of any part will be made without the sanction of the Board.

FOR A GUN OF 10 INCHES CALIBER.

The weight shall be about 30 tons (long).

The length of bore 34 calibers, measured from the face of the obturator to the face of the muzzle of the gun. (In order that the gun may not require a special carriage for its proof, it is desirable that the diameter of the trunnions be 12 inches and the distance between rimbases 42 inches).

The power shall be such as may be expressed by a muzzle energy of not less than 15,000 foot-tons.

The range shall for 20 degrees of elevation be about 13,650 yards, and corresponding ranges shall be obtained with lower elevations.

The standard of accuracy shall be the same as that prescribed for an 8-inch gun.

The endurance shall not be less than 300 rounds with full charges, and a lining may be inserted after 250 rounds.

The weight of projectile with full charges shall be about 575 pounds.

Other conditions for test shall be the same as for an 8-inch gun, except that under general efficiency a rapidity of fire of fifteen rounds per hour shall be attainable.

FOR A GUN OF 12 INCHES CALIBER.

The weight shall be about 52 tons.

The length of bore shall be 34 calibers. (In order that the gun may not require a special carriage for its proof, it is desirable that the diameter of trunnions be 14.5 inches and the distance between rimbases 49.8 inches).

The power shall be such as may be expressed by a muzzle energy of not less than 26,000 foot-tons.

The range shall for 20 degrees elevation be about 14,700 yards, and corresponding ranges shall be attained with lower elevations. The accuracy shall be the same as that prescribed for an 8-inch gun.

The endurance shall not be less than 250 rounds, and a lining may be inserted after 200 rounds.

The weight of projectile for full charges shall be about 1,000 pounds.

Other conditions of test shall be the same as for an 8-inch gun, except that under general efficiency a rapidity of fire of 10 rounds per hour shall be attainable.

The judgment and recommendations of the Board as above set forth have been approved by the Secretary of War, and it is expected that the execution of the contract may soon be in progress.

Other gun contracts.—Under the act of August 18, 1890, the War Department has entered into contract with the West Point Foundry for finishing and assembling eleven 8-inch guns to be made from forgings procured under act of September 22, 1888. These guns are being finished and assembled subject to inspections and tests prescribed by the Board.

INCREASED LENGTH OF HEAVY GUNS.

With the increase in weight of metal thrown by heavy guns has come a demand for slow-burning powders to avoid excessive strains in moving these masses, and such powders in their turn have demanded an increase in the length of the bore of the gun that their full effect may be obtained. Consequently, in foreign services there has been during the past few years a steady increase in the length of guns of 6 to 12 inches caliber. Latterly it has been proposed to increase the total length of our 12-inch breech-loading rifles from 36½ calibers to 40. For such guns of this caliber as are to be mounted on gun lifts or disappearing carriages, any increase of either length or weight is so undesirable that for the present, at least, it is not to be considered. It is, however, very desirable that we should know by actual experience what are the merits and demerits of increased length, and as some of the guns of this caliber are to be mounted on nondisappearing carriages, the Board has recommended that the Chief of Ordnance be authorized to obtain forgings for not to exceed seven guns of this caliber, of 40 calibers total length, and that one of them be finished and tested as soon as possible, but that their manufacture be not allowed to unduly interfere with that of the shorter guns.

EXPERIMENTAL GUNS.

Several types of experimental guns have received the attention of the Board, and are now under fabrication in various stages of progress. The first of these to which the Board calls attention is:

The Haskell multicharge gun, in process of construction by the Has-

kell Multicharge Ordnance Company, at Reading, Pa. Under section 6 of the act of September 22, 1888, the Board on July 20, 1889, allotted $28,000 for the purchase of one 8-inch Haskell multicharge dynamite gun of the model of February, 1889, payment to be made on delivery at proving ground. Subsequently, April 9, 1890, upon request of the Haskell Multicharge Ordnance Company, the Board authorized the substitution of the 10-inch high power steel multicharge gun, at the company's option, for the dynamite gun before provided for, and allotted the sum of $55,000, or so much thereof as might be necessary for the purpose, under the act of September 22, 1888, payments therefor to be made in four equal installments, as the Secretary of War might direct.

On September 3, 1890, the Board was advised by J. R. Haskell, superintendent of the Haskell Company, that his plans for the gun were then nearly completed and his estimates in process of preparation, but what progress has been made in the actual fabrication of the gun the Board is not advised.

This gun is not subject to test of metal or parts by the Government during process of fabrication, nor does it involve the purchase, necessarily, of any other of this type.

Wire-wound guns.—Several guns of the wire-wound type have been brought to the attention of the Board, and two are now in course of fabrication under allotments made by the Board. The first of these is what is known as the Crozier wire-wound gun, which has been approved by the Ordnance Department, and is also known as the Ordnance Department wire-wound gun.

On November 7, 1888, the Board received from the Chief of Ordnance a communication, accompanied by drawings and estimates, for the construction of the Crozier wire-wound gun, and an allotment was made therefor of $32,000. On June 6, 1890, an additional allotment of $14,000 was made for the completion of this gun, on recommendation of the Chief of Ordnance.

This gun is now in course of fabrication by the Ordnance Department at the Army gun factory, and considerable progress has been made with it. At last accounts the steel wire had all been delivered, and the jacket, trunnion hoop and chase hoops, made of cast steel, oil-tempered and annealed, have been contracted for with the Standard Steel Casting Company. The Board is not advised as to the present precise condition of this gun.

This gun consists principally of a steel tube, overlaid from breech to muzzle with a practically continuous covering of steel wire, wound in layers, with a jacket cylinder enveloping the steel wire over the reinforce, and a continuous layer of hoops enveloping the wire over the chase of the gun from the trunnion hoop forward to the muzzle.

Another experimental gun of the wire-wound type now approaching completion is known as the Woodbridge 10-inch wire-wound gun. The fabrication of this gun had been commenced before the organization of this Board, but had been arrested for want of appropriations. For its completion the Board allotted on June 12, 1889, the sum of $20,000.

This is a breech-loading rifle of steel, and consists principally of an inner steel-tube, overlaid for the rear half of its length with a cylinder of closely-fitted steel staves, and then wound with steel wire, tinned, which is afterwards soldered. The entire length of the gun is wire-wound, the wire lying in direct contact with the tube forward of the staves and forming the exterior of the gun, except where covered with the trunnion hoop and sleeve; but the wire portion is separated in the whole length into three sections by steel rings or bands, screwed and shrunk on the cylinder of staves or the tube.

The inventor of this gun, Dr. W. E. Woodbridge, is employed as an assistant at the Watertown Arsenal in connection with its manufacture.

On May 8, 1891, the Chief of Ordnance communicated to the Board his opinion that this gun might be finished in six months from that date, and asked for a further allotment of $2,818 for its completion, which allotment was made by the Board. As the making of this gun has been long delayed, the Board urged "that the work be pushed forward with all due expedition and completed without unnecessary delay." The Board is not advised as to the present condition of this gun.

Still another experimental wire-wound gun, which was approaching completion at the organization of the Board, was the Woodbridge cast-iron wire-wound gun, for the completion of which the Board made an allotment of $1,500. The gun is completed and is now at the ordnance proving ground at Sandy Hook.

Application has been made to the Board to make allotments for other guns of the wire-wound and segmental types, but this has not been deemed wise until the guns above named, involving like principles of construction, have been completed and tested. But the Board has made an allotment of $3,031 for the purchase of ammunition for the test of the Brown segmental wire-wound gun, and has also made an allotment for adapting a carriage for proving or testing the same.

CAST-IRON BREECH-LOADING MORTARS.

Section 6 of the act of September 22, 1888, provided that—

SEC. 6. Whenever any party shall present for test a completed cast-iron breech-loading mortar of twelve inches caliber, of about thirty-two thousand pounds weight, with a proper supply of ammunition therefor not exceeding two hundred rounds, such mortar shall be tested in the presence of the party presenting the same, and should it be shown to the satisfaction of the Board by such tests to be equal in accuracy, range, power, endurance, material, and general efficiency to the twelve-inch cast-iron steel-hooped breech-loading mortar now at Sandy Hook, the mortar and ammunition shall be paid for, including cost of transportation, and contract be made for a further supply of not less than fifty and not more than one hundred, at such reasonable cost as the Board herein provided for shall determine, not to exceed six thousand five hundred dollars each. The entire number to be delivered in one year from date of contract. Said mortar and all which may be contracted for under this provision shall be subject to inspection at each stage of manufacture.

The South Boston Iron Works proposed to present a cast-iron mortar for test under the provisions of this section.

The terms of the statute required that the mortar presented for test should be "shown to the satisfaction of the Board by such tests to be equal in accuracy, range, power, endurance, material, and general efficiency to the 12-inch cast-iron steel-hooped breech-loading mortar now at Sandy Hook."

After much delay the mortar was completed and presented, when a question arose between the Board and the manufacturers as to the correct construction to be placed upon the statute as to the test of the mortar; the manufacturers contending that the test should be limited to 200 rounds, and the Board declaring its intention that the test should continue until the question of equality of "endurance" was decided.

Pending this controversy, however, the question was settled by the bursting of the mortar at the twentieth round. A full report of the firings and the result thereof was submitted to Congress by the Secretary of War January 27, 1890, in House Ex. Doc. 158, first session Fifty-first Congress, to which reference is made for a full history of this

A copy is appended hereto marked D.

ther cast-iron breech-loading mortar has been presented for test
said section.

The Board regards this test as confirming its opinion of the unreliability of cast iron as a material for high-power guns and mortars, and in view of the result now recommends the repeal of so much of section 6 of the act of September 22, 1888, as relates to the purchase of cast iron mortars of this type.

CAST IRON MORTARS HOOPED WITH STEEL.

Section 5 of the act of September 22, 1888, appropriated $250,000 "For the purchase of material for, and the manufacture of, 12-inch breech-loading rifled mortars of cast iron, hooped with steel, of about 32,000 pounds weight, similar to, and equal in range, power, and accuracy of fire to the 12-inch breech-loading mortar, cast iron, steel-hooped, now at the ordnance proving ground, Sandy Hook, N. J., said mortars to be subject to inspection in all stages of manufacture."

The bodies of these mortars, thirty in number, were put under contract to the Builders Iron Foundry, Providence, R. I.; and the forgings for the steel hoops and breech mechanism for the same to the Midvale Steel Company, of Philadelphia.

Twelve of these mortars have been delivered and are now ready for proof at the proving grounds at Sandy Hook.

All the mortars under this contract should be completed by August, 1892.

The test mortar of this type, which has been thoroughly tried, has proved itself an efficient and accurate arm for protecting harbor channels, where a vertical fire is desired; but in view of the greater range, power, and endurance of the all-steel mortar of the same type and caliber, it may well be considered whether, in the end, it will not be true economy to discontinue the manufacture of the cast-iron body, and to make our mortars, as we now do our guns, entirely of forged steel.

By the act of August 18, 1890, a further appropriation of $400,000 was made for cast-iron steel-hooped mortars, which was duly allotted, and contracts have been entered into for forty-three additional mortars. The contract for the cast-iron bodies for these has been let to the South Boston Iron Works, and the steel forgings therefor to the Midvale Steel Company. The cast-iron bodies are to be completed by September 27, 1892, and the mortars ready for delivery within six months after receipt of the forgings. The delivery of these forty-three mortars should therefore commence about April, 1893, and when delivered will complete the seventy-three now provided for.

ALL-STEEL 12-INCH MORTARS.

The Board on October 10, 1889, made allotment, under the act of 1888, of $15,000 for the construction of a forged steel built-up mortar of 12 inches caliber, which amount, with subsequent allotments amounting to $2,850, makes the total cost of the mortar $17,850. The mortar has been completed at the Army Gun Factory, and is now at the ordnance proving grounds at Sandy Hook undergoing test. With this more powerful mortar it is expected to obtain a range of about 8 miles.

SEACOAST GUN CARRIAGES.

The greater weight and power of modern seacoast guns render the metallic gun carriages now on hand unsuited and insufficient for the new service.

The Government has on hand a large stock of carriages designed for the 10 and 15-inch smoothbore guns, which by alteration and strengthening can be adapted to the mounting of the 8-inch converted rifle and the 15-inch smoothbore gun, using increased charges.

Appropriations amounting to $250,000 have been made in the last three years for such alterations, which are going on principally at Watertown Arsenal, Massachusetts.

An appropriation of $27,000 has also been made by the act of 1891 for increasing the facilities of this arsenal in making such alterations.

Besides this, the sum of $100.000 was appropriated by the act of February 24, 1891, for carriages for the new steel breech-loading seacoast guns, procured under the act of September 22, 1888.

In view of the forward condition of the Army gun factory, and of the probable early execution of the hundred-gun contract with the Bethlehem Iron Company, the time would appear to have arrived for the energetic prosecution of the work of providing carriages for the new guns.

In these days of naval range-finders, machine guns, small arms of wonderful precision, and smokeless powders, the handling of heavy guns mounted upon ordinary barbette carriages on low sites is certain to be productive of such destructive results as to forbid its being attempted. The Board has therefore had under earnest consideration various types of disappearing gun carriages, and has also recommended an allotment for a gun lift for 12-inch guns, which is now in course of construction at Sandy Hook, N. J.

A pneumatic gun carriage of the disappearing type for a 10-inch gun, for which allotment was recommended by the Board, has been completed, and is now in position at the same place awaiting test, which the Board expects will be made during the month of November. Of the other designs submitted to the Board only two have been recommended for trial, and these are now in process of construction. They are the Gordon and the modified Buffington carriages. Of the former, a carriage for a 10-inch gun, and of the latter, carriages for a 10-inch and for an 8-inch gun are under construction.

The construction for drill purposes of an experimental nondisappearing barbette carriage for an 8-inch breech-loading rifle, steel, upon designs submitted to and approved by the Board, has also been authorized.

In a matter of so much consequence the Board has deemed it of the utmost importance to proceed with care, and not to recommend large expenditures until satisfied of the excellence of the type.

Up to this time there has been no pressure for seacoast carriages, for the reason that we had not the modern guns to mount upon them. That, however, will no longer be the case, and the proof and construction of this class of carriages should proceed *pari passu* with the completion of guns.

The construction of carriages for field guns progresses favorably and satisfactorily.

SEACOAST MORTAR CARRIAGES.

Contracts have been entered into, as above stated, for seventy-three coast mortars, and the sum of $325,000 has been appropriated for construction of carriages for the same.

The modern high-power breech-loading rifled mortar of about 12 calibers length of bore, being an entirely new arm in our service, carriages

of greater strength and endurance than any heretofore in use, capable of resisting the immense strain of firing a projectile of upward of 600 pounds weight at a great angle of elevation, had to be devised, constructed and tested.

Two types of carriages for these heavy rifled mortars, which are to constitute such an important part of our system of defense, have been purchased under allotments recommended by the Board, and both are now at Sandy Hook, one, the "Spring Return Carriage" undergoing, and the other, the "Canet Hydro-Pneumatic Carriage," awaiting test. While the former has not been entirely successful it has been so to a certain degree, and as it was the only carriage for heavy mortars which had been tested so far, and as the demand for such carriages was becoming urgent, it was thought that the defects developed, being simply of construction and not inherent in the design, the Board was justified in consenting to the request of the Chief of Ordnance and recommending the allotment of $100,000 for the construction of mortar carriages of this type. Accordingly, in February of this year such action was taken, the Board stating that it did not feel at liberty to recommend a larger allotment in view of the information then before it.

It is estimated that the present appropriations will procure about twenty-five of these carriages, leaving forty-eight mortars now under contract to be provided with carriages by future appropriations.

The devising of the best possible carriage for these high-power seacoast mortars is an inviting field for inventive genius, and a number of elaborate essays in this direction have come before the Board.

As either guns or mortars are useless without carriages adapted to their services, the time has arrived, in the judgment of the Board, for providing such carriages as rapidly as the guns and mortars shall be turned out, so that they may be at once placed in position.

GUN AND MORTAR BATTERIES.

By the fortification act of 1890, the expenditure of the appropriation of $1,221,000 for gun and mortar batteries at Boston, New York and San Francisco was placed under the supervision of this Board and on September 2, 1890, the same was allotted to the several objects in accordance with the project upon which the appropriation was based.

SUBMARINE MINES AND TORPEDOES.

Among the earliest objects of appropriation under the new policy of harbor defense, were submarine mines and torpedoes.

Following large appropriations previously made, the act of September 22, 1888, appropriated $250,000 for these and allied objects, and the further sum of $200,000 for the same objects was granted in the act of March 2, 1889. The expenditures under the acts above named were under the supervision of this Board.

Such liberal appropriations show the importance which the legislative branch of the Government attached to these methods of defense.

Recognizing the importance of these preparations, allotments were promptly made for the procurement of fixed torpedoes or submarine mines, and the Board approved the prosecution of continued and thorough experiments and tests to ascertain the most practicable and effective movable torpedo, controllable from the shore. These latter experiments as heretofore have been conducted at the Engineer Station at Willets Point, Long Island, under the direction and immediate super-

vision of the Engineer Department. Considerable progress has been made in these tests and the experiments are still continued.

Investigations looking to the development of a system for harbor defense by submarine mines were actually begun in 1869. In consequence of this, and of the much less time required for the construction of the material than of high-power guns and mortars and their mountings, the condition of the submarine mine defenses of our harbors is in a better state of forwardness than that of any of the other elements.

Of course it is not necessary that the mines shall be planted until the exigency shall arise; but a considerable supply of electrical operating apparatus, cases, anchors and small parts have been gradually accumulated; several shore stations have been constructed or are in process of construction, and all the more permanent parts of the system are kept in a state of readiness for use.

The manufacture of electrical cables and appliances has been immensely developed of late in this country, and it is believed that the necessity of placing large quantities of these perishable articles in store no longer exists. A supply sufficient to meet the first demand will suffice.

The principal harbors have been carefully studied, the position for each mine is indicated upon charts filed in the War Department, and a force of engineer officers and soldiers has been thoroughly trained in the loading, planting and connecting of these mines with the shore stations and in the operating of the system in war.

It is hardly necessary to say that submarine mines are not designed to constitute an independent system of defense. They form but one part of a combined system, the more important element of which consists in powerful shore batteries of high-power guns and mortars.

The mine fields are designed to delay hostile ships under fire until these heavy batteries can make their fire effective. Cable galleries connect the mines with the protracted shore stations and the electrical appliances designed for firing the mines, while the rapid-fire guns protect the mines from interference by the enemy, and also repel attacks upon the shore batteries or stations. Without the heavy batteries of high-power guns and mortars these appliances would be of no great value, as they could be removed or countermined by the enemy.

The Board calls attention to this feature of the case in order to emphasize the fact that the earliest production of an adequate number of modern high-power guns and mortars is the central and an all important element in the defense of our great seaports. Until this is accomplished all other preparations are insufficient and ineffective.

The movable torpedo under control from shore stations is an offensive weapon the powers of which are not yet fully developed. It is of limited range, of uncertain accuracy, and of so complex mechanism as to be liable to frequent failures. Its true function is the defense of mine fields; and for this purpose it appears worthy of the development, bearing in mind, however, that it can never constitute more than an auxiliary defense.

ERICSSON AËRIAL SUBAQUATIC PROJECTILE.

Among other subjects which have engaged the attention of the Board is the Ericsson aërial subaquatic projectile. This is an invention owned by the Ericsson Coast Defense Company and is attributed to the distinguished inventor John Ericsson, the designer of the original *Monitor*. The claim made for this device is that it can be fired from either a pneu-

matic gun or from a powder gun modified from one of our smoothbore 15-inch guns, and after a considerable aërial flight will on striking the water descend to a depth below the surface for which it may have been previously adjusted. Reaching such depth, it will without change of direction proceed on its course, the path pursued remaining straight and practically parallel to the surface of the water. Whether the company will be able to make the projectile accomplish what is claimed can of course be only determined by actual trial, and in view of the great advantages offered by this invention, if it should prove successful, the Board has recommended an allotment of $11,333.33 for the purchase of four of these projectiles.

They have been delivered and are awaiting the receipt of one of the pneumatic guns now under contract, with which they will be tested.

RAPID-FIRE GUNS.

A matter which has engaged the attention of the Board to a considerable extent for some time past has been the investigations necessarily preliminary to the determination of the proper type of gun for the protection of the mine areas or torpedo fields arranged for obstructing the channels of approach to our harbors and for flanking the shore batteries. Such a gun must be of the rapid-fire type, and its ammunition should belong to the smokeless variety. These conditions being adopted as essential, the Board, after careful study of the necessities of the case and a comparison of the merits and demerits of the various systems and calibers adopted throughout the world, recommended in May last that the Canet, the Armstrong, and the Hotchkiss types of rapid-fire gun be tested. Of the guns ordered—and which, it is hoped, will be delivered in a few months—each is mounted upon the carriage which the manufacturer deems best suited to develop its capabilities. All three are of the same caliber, namely, 4.72 inches, and each employs smokeless powder. Ammunition to the amount of five hundred rounds for each gun has also been ordered. It is proposed to submit these guns to a thorough test with a view to determining which is best suited for the purpose required.

The Board has also made an allotment for a Driggs-Schroeder 6-pounder rapid-fire gun, which is now in the hands of the Ordnance Department for test.

Attention has also been given to several types of breech mechanism intended to facilitate rapidity of fire. The Gerdom and Seabury systems are now being experimentally applied, respectively, to the field (3.2-inch) and siege rifle (5-inch) gun, while still other systems are yet under consideration by the Board.

HIGH EXPLOSIVES.

A subject that has engaged much of the attention of the Board is that of explosives, and especially of high explosives and projectiles for their use. Numerous varieties have been brought to the attention of the Board and have received its careful consideration.

A committee of the Board, consisting of Gen. Abbot and Col. Mordecai, has been charged with a series of investigations and experiments to determine what form of high explosive and what method of charging the projectile are best adapted to the exigencies of coast defense. The trials were conducted by the Ordnance Department. Attention is invited to the appended reports from this committee (Appendix E), one,

dated June 5, 1889, submitting the general programme which was adopted by the Board, and the other, dated October 12, 1891 (which also meets with the approval of the Board), reporting progress to date, with the conclusions resulting therefrom, together with a programme for the further prosecution of the trials in the early future.

It is too early to say that a conclusion has been reached; but the Board hopes that the problem may be solved of firing a shell charged with a satisfactory high explosive of sufficient destructive energy from an ordinary rifled gun without danger of premature explosion. Such a problem is one to command the best attention of scientific military men and of inventors.

In this connection attention is called to the fact that large appropriations have been made for pneumatic dynamite guns. Should the result above indicated be reached, the pneumatic gun would be superseded, as the shortness of its range will cause it to remain under the fire of the enemy's long-range high-power rifles until the hostile ship elects to come within its sphere of action.

PROJECTILES.

By the acts of 1890 and 1891 there was appropriated $63,000, mostly for cast-iron projectiles, the greater part being for experimental firing with seacoast high-power guns and mortars and shell for testing explosives; $40,000 for steel shell for seacoast guns, and $200,000 for steel armor-piercing projectiles. These appropriations were promptly allotted by the Board.

The armor-piercing projectiles are in part for experimenting with the high-power seacoast guns and partly for permanent supply.

These armor-piercing projectiles are made with the same care and subject to the same inspections as the guns themselves, since the destructiveness of the fire must depend upon the excellence of the projectile. They are made from forged steel, tempered and annealed. For the larger calibers a piece cut from every shot is subjected to thorough tests in the testing machine, and, after completion, samples are put to the most searching ballistic tests by firing against armor plate one and one eighth times the caliber of the projectile in thickness. Elaborate regulations satisfactory to the Board for the inspections and tests of the steel, as well as for the completed projectile, have been prescribed by the Ordnance Department.

It is estimated that the appropriation now available will procure two hundred and twenty 8-inch, two hundred and twenty 10-inch, and two hundred 12-inch projectiles. These are now under contract with the Midvale Steel Company, of Philadelphia.

No projectiles have yet been manufactured under this contract.

BREECH-CLOSING DEVICES.

Among other breech-closing devices the Board has given careful consideration to that invented by Col. Theodore Yates, U. S. Army (retired). This device Col. Yates claims is equally applicable to heavy or to light guns. It has been the intention of the Board to purchase a sample mechanism of this kind from Col. Yates and have it applied to the standard field gun, but no gun suited to receive it being available, such action
yet been taken.
his purpose an allotment was made May 2, 1890, of $250.

ARTILLERY SIGHTS.

The subject of artillery sights has also received attention at the hands of the Board, and three sights designed by officers of our artillery service (Capt. Zalinski and Lieuts. Best and Carbaugh) are already either completed and undergoing test or are in process of construction, under allotments recommended by the Board. Allotments have also been recommended for the procurement from abroad of the Scott and the Grenfel sights, and the Bode Quadrant Sight for trial.

RANGE AND POSITION FINDERS.

The increased range of modern guns and the increased cost of artillery ammunition, which naturally restricts peace practice, have directed attention of late to various optical and mechanical devices for determining the location of a distant object. These instruments all proceed upon the well-known principle of determining the elements of a triangle, at the vertex of which is the object, while the base of known length and the two base angles are within the reach of the operator. These three elements of the triangle being ascertained, the distance and direction of the object from the gun can be determined. In some instruments the base line is horizontal; in others it is vertical, and is the elevation of the instrument above the surface of the water. The distance may be made known by electrical indicators, or by converging radial arms moving over a map of the harbor approaches. The various military powers of Europe have systems of range finding for use in their harbors, the details of which are preserved with the greatest secrecy. In this country invention in the same direction has been stimulated by reports of what has been done abroad, and, as the consequence, this Board has had before it so many inventions of this kind that it has been compelled to ask for the appointment of a distinct range finder board to act under it in the test of such completed instruments as may be ordered by this Board.

The subject is as yet far from being exhausted, and the Board is not prepared to make any recommendation looking to the definite adoption of any system. But completed instruments of the Fiske, Ruckman-Crosby, Berdan, and Lewis types have been purchased, and, with the exception of the last named, have been tested by the range finder board. The reports of that board, showing what defects have been found in the instruments, have been referred to the inventors in the hope that they may be able to obviate them. The Lewis instrument is now being prepared for test at Fort Wadsworth, New York Harbor.

The Board has also made an allotment for the purchase of a portion of a novel position finding instrument invented by Henry Hess, which will test the fundamental principle of its construction. This portion, it is thought, will determine the availability of his system.

The Board is still in correspondence with several other inventors who are hopeful of arriving at the successful solution of this important problem.

SÉBERT VELOCIMETER.

Among the matters for which the Board has made allotment is the Sébert Velocimeter, an instrument used for measuring velocities in the bore of a piece, and at any point beyond the muzzle. This gives valuable and much-needed information for use in determining the various

factors entering into the intricate problem of gun construction and the preparation of suitable powders. The instrument is now in use at the Proving Ground at Sandy Hook.

AMMUNITION WAGON.

A question which has for many years engaged the attention of military men in all countries has been that of furnishing an adequate supply of ammunition to the fighting line. Many devices have been proposed for this purpose, but of those which the Board has had before it all have been considered impracticable except that of Lieut. Kimball of the Navy. To enable a test to be made the Board recommended that one be purchased at a cost of $600. It has been sent to the Infantry and Cavalry School at Fort Leavenworth for trial.

FUSES.

The number of fuses which have been submitted to the Board is very small in proportion to the number of other inventions. So far only three have been presented whose promise of successful results was sufficient to justify the Board in making allotments to procure samples. Of these two are American, namely, the Merriam base percussion fuse, for which allotment was first made on November 4, 1890; and the Berdan mechanical distance fuse, which the Board decided on December 12, 1890, to test, and for which it has since made several allotments of small amounts to continue the experiments. The foreign fuse is French, being made by the Ar. Walter Company of France. Allotment of $150 was made on June 6, 1891, to procure fifty of these fuses.

None of the tests of these fuses has yet proceeded sufficiently far to justify a definite opinion upon their merits.

SITE FOR AN ORDNANCE PROVING GROUND.

Among other duties imposed upon the Board by Congress was that of making an examination of "a site or sites for ordnance testing and proving ground to be used in the testing and proving of heavy ordnance, having in view in the selection of said site or sites their accessibility by land and water, means of transportation, and suitability for the purpose intended, and also the actual and reasonable cost, and the value of the land embraced in said site or sites, and the least sum for which the same can be procured." The result of the examination into this subject by the Board has already been submitted to Congress and has been printed in House Ex. Doc. 148, Fifty-first Congress, first session, a copy of which is hereto appended, marked F.

GENERAL AND SPECIAL DUTIES OF THE BOARD.

The Board has thus briefly presented a report of its "general operations from the beginning of the operations of the Board" until the date of making this report.

The practical operation of the Board may be stated, by way of illustration, as follows:

Such appropriations as are made by Congress upon estimates and projects furnished by the Chief of Engineers and the Chief of Ordnance subject to the supervision of the Board are communicated to it through the Secretary of War, with requests for such allotments for specific objects as are considered essential from time to time.

The Board investigates the subject-matter, calls for such information as it may need, and after full information and consideration the allotment is recommended of such amount as the Board is satisfied should be made. This recommendation goes to the Secretary of War for his approval.

Or, a communication is received from the inventor of a gun, projectile, carriage or other device or engine of war, either directly or by reference of the Secretary of War. The communication is taken up by the Board, considered, further information asked, drawings and specifications required, and after careful investigation it is decided whether the invention is worthy of trial or not. If the decision is favorable, recommendation is made for the purchase or manufacture of a sample of the invention or device, which recommendation is submitted to the Secretary of War for his approval.

In addition to the general duties of the Board, others of a special nature have been imposed upon it by special provisions of law from time to time. Such were the prescribing of tests and the testing of the 12 inch cast-iron mortar; the prescribing of tests and testing of 10 or 12-inch steel guns, to be presented for test and purchase under section 6 of the act of September 22, 1888; the examination of sites for an ordnance proving ground, under the Army appropriation act of 1889; the prescribing of conditions and tests, and adjudging upon the purchase of one hundred guns by contract, under the acts of 1890 and 1891; the making of "all needful and proper purchases, experiments and tests to ascertain, with a view to their utilization by the Government, the most effective guns, small arms, cartridges, projectiles, fuses, explosives, torpedoes, armor plates and other implements and engines of war, and to purchase or cause to be manufactured, under the authority of the Secretary of War, such guns, carriages, armor plates and other war materials and articles as may, in the judgment of the Board, be necessary in the proper discharge of the duty devolved upon it by the act approved September 22, 1888," as required by the act of February 24, 1891.

The extent and complexity of the work may be judged from the following summary:

The Board held its first sessionOctober 30, 1888, and during the three years to October 30, 1891. has held thirty-one regular sessions averaging over four days to each session, or about one hundred and twenty-seven working days in all. It has made reports of each session, in the form of a journal, to the Secretary of War, and these reports, with extracts furnished to private persons and others, and other reports made by the Board, occupy over 1,700 typewritten pages of record.

The Board has examined and acted upon over 350 inventions of various kinds. These include guns and improvements in the same, mortars, high explosives; and guns, shells and systems for firing high explosives; small arms, machine and rapid-firing guns, batteries, gun carriages, shells and other projectiles, metals for gun construction, range and position finders, plans for coast defense, and movable torpedoes, sights, powders, breech mechanisms for guns, air-ships or balloons, cartridges, defensive and ammunition wagons, electric arms, and other appliances of electricity in warfare, fuses, defensive shields, land locomotive, optical devices, target, ammunition hoist, surveying compass, and war rocket. The consideration of these inventions and other business has required the examination of fully 2,500 papers, including over 300 drawings. Each inventor or person interested has been promptly informed of the action finally taken upon his invention, and about 60 hear-

ings of inventors and others were had before the Board in explanation of matters under consideration, the record of which, made by the stenographer of the Board, contains over 1,600 folios.

SUMMARY.

When Congress resumed measures for the defense of the coast there was no place in the United States where forgings for 10 and 12-inch steel guns could be produced, and no factory where they could be finished and assembled either by private parties or under the control of the War Department.

There are now certainly two great plants where forgings up to 12-inch guns can be turned out with reasonable dispatch, and a gun factory where they can be finished and assembled. Types of 8, 10 and 12-inch guns have been completed and either tested or are awaiting proof. It is expected that by January 1, 1892, the factory will have turned out nine 8-inch, five 10-inch and two 12-inch guns. Eleven guns of 8-inch caliber are under contract with the West Point Foundry; one hundred guns of 8, 10 and 12-inch caliber are practically under contract with the Bethlehem Iron Company; seventy-three 12-inch sea-coast mortars are under contract or completed. Types of gun and mortar carriages have been procured and are undergoing tests; considerable success has attended the efforts to produce an American slow-burning prismatic powder that shall render the United States independent of foreign manufacturers; a beginning has been made on the construction of gun and mortar batteries for the protection of our most important ports; while general advance has been made along the whole line of defensive preparation. Four years continuance of similar legislation and activity, and it can no longer be said that the United States are defenseless against foreign powers.

It is to be hoped that these defensive preparations may never be required in actual warfare. That they are *made* is the best possible guaranty that they will not be called into hostile use.

J. M. SCHOFIELD,
Major-General, U. S. Army, President of the Board.
HENRY L. ABBOT,
Colonel, Corps of Engineers,
Brevet Brig. Gen., U. S. Army.
HENRY W. CLOSSON,
Colonel, Fourth Artillery.
A. MORDECAI,
Colonel, Ordnance Department, U. S. Army.
BYRON M. CUTCHEON,
Civilian Member.

D. M. TAYLOR,
Captain, Ordnance Department, Recorder of the Board.

INDEX FOR FIRST ANNUAL REPORT TO CONGRESS MADE BY THE BOARD OF ORDNANCE AND FORTIFICATION.

	Page.
Aërial sub-aquatic projectile, Ericsson	24
All steel 12-inch mortar	21
Allotments for Army gun factory	10
for steel forgings for guns	13
for Watervliet Arsenal, old gunshop	11
recommendations of Board with regard to, only advisory	9
total amount of	9
Ammunition wagon, Kimball's	28
Appropriations, detailed statement of all made (Appendix A)	35
for seacoast gun carriages	22
for mortar carriages	23
for necessary expenses of Board, by whom expended	9
total of all made, subject to supervision of Board (Appendix A)	35
Armstrong rapid-fire gun ordered	25
Arsenal, Watervliet, establishment of gun factory at	9
old gunshop at, allotments made for	11
Artillery sights	27
Army gun factory, additional appropriations for, made	10
how far completed in two years	10
original act with regard to	9
provision for south wing of	10
what equipped for, when completed	11
what now turning out	11
Batteries, gun and mortar	23
Berdan mechanical distance fuse	28
range finder ordered	27
Best, artillery sight	27
Bethlehem Iron Company to furnish certain completed steel guns	15
steel forgings for guns	12
Board, advisory to Secretary of War	9
conclusions of, with regard to contract guns	15
duties, general and special	28
expends no appropriation except for necessary expenses	9
jurisdiction of	8
organization of	7
makes no contracts	9
prescribed weight, dimensions, inspections, tests, etc., of contract guns	14
recommendations of, with regard to increased length of heavy guns	18
views of, with regard to machinery, etc., for constructing 16-inch guns	11
Breech-closing device, Yates	26
loading cast-iron mortars, provisions of law as to	20
controversy as to test of	20
Buffington modified disappearing gun carriage	22
Bureaus to make expenditures	9
Canet rapid-fire gun ordered	25
Carbaugh artillery sight	27
Carriages, disappearing gun, need for	22
action with regard to	22
for field guns	22
for seacoast guns, appropriations for	22
mortar, seacoast, appropriations for	22
Canet	23
spring return	23
Cast-iron breech-loading mortar	20
mortars hooped with steel	21

	Page.
Civilian member of Board appointed	8
salary of	8
Committee of Board on high explosives (Appendix E)	25
Contracts, none made by Board	9
for cast-iron mortars hooped with steel	21
Contract guns, Board prescribed weight, dimensions, tests, &c., of	14
certain steel forgings for, to be finished and assembled by West Point foundry	18
conclusions of Board with regard to	15
first provisions of law with regard to	13
functions of Board with regard to	15
subsequent legislation with regard to	14
to be furnished by Bethlehem Iron Company	15
time of delivery of	16
other bidders for	15
West Point Foundry to finish and assemble	18
Crozier wire-wound gun	19
Delivery, time of, of contract guns	16
Designation of members of Board	8
recorder of Board	8
Disappearing gun carriages	22
Driggs-Shroeder rapid-fire gun, allotment for	25
Duties of Board, general and special	28
Ericsson aërial sub-aquatic projectile	24
Expenditures, how made	9
total, for necessary expenses of Board up to October 30, 1891	9, 44
total (except for necessary expenses)	9
Experimental guns	18
Explosives, high, committee of Board on	25
reports (Appendix E)	68
Field and siege guns, fabrication of, at Watervliet Arsenal	11
Field guns, carriages for	22
Fiske range and position finder ordered	27
Forgings, steel, for guns	12
Fuses	28
General and special duties of Board	28
operations of Board	9
Gordom breech mechanism	25
Gordon disappearing gun carriage	22
Gun carriages for seacoast guns, appropriation for	22
disappearing, need for	22
disappearing, action with regard to	22
for 8-inch breech-loading rifle for drill purposes	22
for field guns	22
Gun factory, Board's views as to machinery for 16-inch guns at	11
Gun and mortar batteries	23
Guns, contract, Board prescribed weights, etc., of	14
conclusions of Board as to	15
first provisions of law with regard to	13
functions of Board in connection with	15
subsequent legislation	14
time of delivery of	16
to be furnished by Bethlehem Iron Company	15
other bidders	15
West Point Foundry to finish and assemble certain	18
experimental	18
increased length of heavy	18
Haskell multicharge	18
rapid-fire	25
steel forgings for, appropriations for	12
number provided for	12
number yet to be provided for	13
regulation for inspection of	12
wire-wound, Crozier	19
Woodbridge	19
Haskell multicharge gun	18
guns, increased length of	18
nry, range and position finder	27
plosives, committee on	25

	Page.
Hotchkiss rapid-fire gun ordered	25
Increased length of heavy guns	18
Inspection of contract guns provided for by Board	12
steel forgings for guns	12
Jurisdiction of Board	8
Kimball ammunition wagon	28
Law requiring Board to make report	7
Length of heavy guns increased	18
Lewis range and position finder	27
Machinery, for construction of 16-inch guns at gun factory, views of Board on	11
Members of Board, order designating	8
civilian, appointed	8
Members of committee on high explosives	25
Merriam base percussion fuse	28
Midvale Steel Works to furnish certain steel forgings for guns	12
Mines, submarine, and torpedoes	23
Mortar carriages, seacoast, Canet	23
spring return	23
and gun batteries	23
Mortars, all steel, 12-inch	21
cast iron, breech-loading	20
hooped with steel	21
number delivered	21
under contract	21
Multicharge gun, Haskell	18
Necessary expenses of Board, only appropriation expended by Board	9
Number of steel forgings for guns provided for	12
to be provided	13
Operations, general, of Board	9
Order designating members of Board	8
recorder	8
Ordnance proving ground, site for (Appendix F)	28, 83
Organization of Board	7
Pneumatic gun carriage	22
Position finders, range and	27
Projectile, Ericsson, aërial sub-aquatic	24
Projectiles	26
Proving ground, ordnance, site for (Appendix F)	28, 83
Range and position finders	27
Rapid-fire guns, need for	25
types of, selected	25
Recorder of board, designation of	8
changed	8
Report of Board, general summary of	30
law requiring	7
Seabury breech mechanism	25
Seacoast gun carriages	21
mortar carriages	22
Sébert velocimeter	27
Segmental wire-wound gun, Brown	20
Siege and field guns, fabrication of, at Watervliet Arsenal	11
Sights, artillery	27
Site for ordnance proving ground (Appendix F)	28, 83
Sixteen-inch guns, views of Board as to machinery for	11
Special and general duties of Board	28
Spring return mortar carriage	23
Steel forgings for guns, appropriations for	12
inspection of, regulations for	12
number of, provided for	12
still to be provided for	13
Steel mortar, 12-inch	21
Sub-aquatic projectile, Ericsson's aërial	24
Submarine mines and torpedoes	23
Summary of report of Board	30
work done by Board	29
Test of breech-loading cast iron mortar, controversy as to	20
Time of delivery of contract guns	16
Torpedoes and submarine mines	23

	Page.
Velocimeter, Sébert	27
Views of Board with regard to machinery for constructing 16-inch guns at gun factory	11
Wagon, ammunition, Kimball's	28
Walter fuze	28
West Point foundry to finish and assemble gun forgings	18
Wire-wound gun, Brown segmental tube	20
Crozier	19
Woodbridge	19
Work of Board, summary of	29
Yates breech-closing device	26
Zalinski artillery sight, telescopic	27

Appendix A.

Appropriations made for the objects specified to be expended under the direct supervision of the Board.

Under the act approved Sept. 22, 1888.	Appropriated.	Allotments.		Remarks.
		Date.	Amount.	
SEC. 2. For the protection, preservation, and repair of fortifications and other works of defense.	$100,000.00	Oct. 30, 1888.	$100,000.00	
For the construction of sea walls, and for earth embankments	117,000.00	....do	117,000.00	
For torpedoes for harbor defense; the purchase of submarine mines and necessary appliances to operate them; for needful casemates, cable galleries, and appliances to render it possible to operate submarine mines; for continuing torpedo experiments; for practical instruction of engineer troops in detail of the service, and for the purchase of movable submarine torpedoes controlled at will by power transmitted from shore stations.	200,000.00	....do	200,000.00	
SEC. 3. For the completion of the guns now under fabrication by the Ordnance Department and for testing the same, and for the manufacture or purchase and test of cannon and carriages, including carriages manœuvred by power, one of which shall be a disappearing carriage, and also including those for the field and siege services; for the alteration of carriages on hand to adapt them to improved service guns; for projectiles, powders, fuzes, and implements, their trial and proof; for experiments in the means of protecting torpedo lines; for compensation of draftsmen while employed in the Army Ordnance Bureau on ordnance construction, and for the necessary expenses of ordnance officers while temporarily employed at the proving ground and absent from their proper stations, at the rate of two dollars and fifty cents per diem while so employed.	500,000.00	Oct. 30, 1888, to Sept. 22, 1891.	497,065.41	Balance $2,934.59.
For examining, testing, and experimenting with pneumatic or other dynamite guns, gun carriages, aërial torpedoes, dynamite shells and ammunition, and batteries for coast defense, whether sunken counterpoise, or otherwise, brought to the notice of said Board.	100,000.00	Nov. 10, 1888, to Feb. 13, 1891.	48,333.33	Balance $51,666.67.
Provided, That all material purchased under this section, excepting samples, shall be of American manufacture.				
SEC. 4. For the erection, purchase, or manufacture of the necessary buildings and other structures, machinery, tools, and fixtures for an army gun factory for finishing and assembling heavy ordnance, to be erected at the Watervliet Arsenal, West Troy, New York.	700,000.00	Nov. 6, 1888, to Nov. 8, 1888.	700,000.00	
Provided, That not exceeding twenty thousand dollars of this sum may be used for the erection and completion of two sets of officer's quarters.				
For the purchase of rough-finished, oil-tempered, and annealed steel for high-power coast-defense guns of eight, ten, and twelve inch caliber, in quality and dimensions conforming to specifications, subject to inspection at each stage of the manufacture, and including all the parts of each caliber.	1,500,000.00	Nov. 6, 1888	1,500,000.00	
Provided, That no money shall be expended except for steel accepted and delivered, and no contract shall be made hereunder for gun steel at a greater average price per pound for each caliber than the lowest average price paid under contracts hitherto made by the Government for American forgings of like caliber.				

Appropriations made for the objects specified to be expended under the direct supervision of the Board—Continued.

Under the act approved Sept. 22, 1888.	Appropriated.	Allotments.		Remarks.
		Date.	Amount.	
SEC. 5. For the purchase of the material for, and the manufacture of, twelve-inch breech-loading rifled mortars of cast iron, hooped with steel, of about thirty-two thousand pounds weight, similar to, and equal in range, power, and accuracy of fire to the twelve-inch breech-loading mortar, cast iron, steel-hooped, now at the ordnance proving ground, Sandy Hook, New Jersey, said mortars to be subject to inspection in all stages of manufacture.	$250,000.00	Nov. 6, 1888	$250,000.00	
SEC. 6. The Board is authorized to make all needful and proper purchases, investigations, experiments, and tests to ascertain, with a view to their utilization by the Government, the most effective guns, including multicharge guns and the conversion of Parrott and other guns on hand, small arms, cartridges, projectiles, fuzes, explosives, torpedoes, armor-plates, and other implements and engines of war; and the Secretary of War is hereby authorized to purchase or cause to be manufactured, such guns, carriages, armor-plates, and other war materials and articles as may, in the judgment of said Board, be necessary in the proper discharge of the duty herein devolved upon them: *Provided*, That the amount expended and liabilities incurred in such purchases, investigations, experiments, and tests shall not exceed five hundred thousand dollars, which sum is hereby appropriated: *Provided further*, That said Board shall test, and if found satisfactory, shall purchase two breach-loading field guns of three and two-tenths inch bore of aluminum bronze.	500,000.00	Oct. 31, 1888, to Sept. 22, 1891.	481,847.02	Balance $18,152.98.
For payment of the necessary expenses of the Board, including a per diem allowance to each member thereof when employed on duty away from his permanent station, of two and one-half dollars a day.	5,000.00	Expended to Aug. 15, 1891	5,000.00	
Total	3,972,000.00	.....	3,899,245.76	Balance $72,754.24.
Under the act approved Mar. 2, 1889.				
Under the act making *appropriations for the support of the Army* for the fiscal year ending June thirtieth, eighteen hundred and ninety, and for other purposes, approved March 2, 1889, were appropriated the following:				
To enable the Secretary of War to cause examinations and tests to be made in converting the existing cast-iron ordnance of the War Department into steel-lined breech-loading torpedo howitzers for throwing high explosives, according to the plans heretofore submitted to Congress and to be submitted to the Board of Ordnance and Fortification.	15,000.00	.....	.....	This appropriation was annual and lapsed with the fiscal year.
The Board of Ordnance and Fortification is hereby directed to examine and report upon a site or sites for ordnance testing and proving ground to be used in the testing and proving of heavy ordnance, having in view in the selection of said site or sites their accessibility by land and water, means of transportation, and suitability for the purpose intended, and also the actual and reasonable cost, and value of the land embraced in said site or sites and the least sum for which the same can be procured. Said Board shall report thereon to the Secretary of War, to be submitted to Congress at its next session; and in case the said Board shall select a site or sites and recommend their purchase, the Secretary of War is hereby authorized to secure written proposals for the sale of the land so recommended, until such time as Congress may act upon the recommendation of said Board and of the Secretary of War.				

For the necessary expenses under the foregoing provision	1,000.00		556.20	Balance $443.80 turned into the Treasury.
For the construction of a counterpoise battery to mount a seacoast rifled gun. Said battery to be located at such point as the Board of Ordnance and Fortification may direct: The erection of such battery shall be by the inventor thereof under the general direction of the Board of Ordnance and Fortification and shall be completed within twelve months from the time this act shall take effect, and the gun to be mounted thereon with its fittings shall be furnished by the Ordnance Department of the Navy.	40,000.00	June 12, 1889, to Feb. 13, 1890.	2,600.00	Balance not expended, $37,400. This appropriation was continued by Fortification act, approved August 18, 1890, for that fiscal year only, and has lapsed.
Total	56,000.00		3,156.20	All allotments under this act have been expended or covered into the Treasury.
Under the act approved Mar. 2, 1889.				
Under the act approved March 2, 1889, *making appropriations for fortifications and other works of defense*, for the armament thereof, for the procurement of heavy ordnance for trial and service, and for other purposes, were appropriated the following:				
Preservation and repair of fortifications: For the protection, preservation, and repair of fortifications.	100,000.00	June 13, 1889	100,000.00	
For preparation of plans for fortifications	5,000.00	Oct. 21, 1891	5,000.00	
Torpedoes for harbor defense: For the purchase of submarine mines and necessary appliances to operate them for closing the channels leading to our principal seaports.	250,000.00	June 13, 1889	250,000.00	
For needful casemates and cable galleries to render it possible to operate submarine mines.	250,000.00	....do	250,000.00	
For continuing torpedo experiments and for practical instruction of engineer troops in the details of the service.	30,000.00	....do	30,000.00	
For the purchase of movable submarine torpedoes, in the discretion of the Board on Ordnance and Fortification.	50,000.00	May 3, 1890	25,225.00	$247,775 unallotted.
For torpedo shed at San Francisco Harbor	22,000.00	June 13, 1889	22,000.00	
Armament of fortifications: For the finishing and assembling of eight-inch, ten-inch, and twelve-inch steel guns made from forgings procured under the act of September twenty-second, eighteen hundred and eighty-eight.	35,000.00	May 2, 1890	35,000.00	
For the purchase of steel forgings for field and siege cannon, as follows:				
For steel forgings for not less than twenty-four three and six-tenths inch field guns	24,000.00			$24,000 unallotted.
For steel forgings for not less than ten five-inch siege guns	20,000.00	May 2, 1890	20,000.00	
For steel forgings for not less than ten seven-inch siege howitzers	18,000.00	Oct. 1, 1890	18,000.00	
For steel forgings for not less than sixteen three and six-tenths inch field mortars	2,000.00	Mar. 26, 1891	2,000.00	
For manufacture of field and siege cannon (finishing and assembling) within the fiscal year eighteen hundred and ninety.	14,000.00			$14,000 unallotted. This amount was reappropriated under the act of 1890.
For the test of experimental guns procured under the act of September twenty-second, eighteen hundred and eighty-eight, namely:				
For one ten-inch wire-wound gun, steel	28,000.00	June 11, 1889	28,000.00	
For one twelve-inch gun, steel hooped	39,500.00	....do	39,500.00	
For procuring one ten-inch disappearing gun carriage	13,500.00	May 6, 1891	13,500.00	This sum was allotted May 6, 1891, from the act approved Feb. 24, 1891, which reappropriated it from act of March 2, 1889, in addition to the $56,500 in said act of Feb. 24, 1891.
For gun platforms at proving ground	6,500.00	June 11, 1889	6,500.00	
For projectiles for field, siege, and seacoast guns for issue to the service	28,500.00	....do	28,500.00	
For siege-gun powder for issue to the service	7,000.00	....do	7,000.00	
For fuzes and implements for issue to the service	2,000.00	....do	2,000.00	

Appropriations made for the objects specified to be expended under the direct supervision of the Board—Continued.

Under the act approved Mar. 2, 1889.	Appropriated.	Allotments.		Remarks.
		Date.	Amount.	
For the alteration of barbette carriages for ten-inch smoothbore guns to adapt them to the service of eight-inch muzzle-loading converted rifles.	$54,000.00	June 11, 1889	$54,000.00	
For the alteration of barbette carriages for fifteen-inch smoothbore guns to adapt them to present service conditions.	46,000.00	....do	46,000.00	
For the manufacture of carriages for twelve-inch breech-loading rifled mortars, procured under the act of September twenty-second, eighteen hundred and eighty-eight.	100,000.00	Feb. 13, 1891	100,000.00	
For the manufacture of forty caissons and ten combined battery wagons and forges for three and two-tenths inch field guns.	43,274.00	June 12, 1889	43,274.00	
For procuring the necessary instruments and other materials and for the proper installation of instruments for conducting the annual heavy artillery practice of the Army.	20,000.00	....do	20,000.00	
For repairs and improvements at the ordnance proving ground, Sandy Hook, New Jersey, namely:				
Repairing dock and dredging $5,500.00				
Relaying roads and walks 3,800.00				
Repairs to officers' quarters 2,000.00				
Repairs to foreman's and soldiers' quarters 2,600.00				
Repairs to office 500.00				
Repairs to shops and storehouses 1,000.00				
Machinery for shops 4,000.00				
Clearing ground about ranges 600.00				
Laying narrow-gauge tramway to proof butts and targets 5,320.00				
	25,320.00	....do	25,320.00	
Provided, That all material purchased under this act shall be of American manufacture.				
Total	1,233,594.00	.....	1,170,819.00	Balance $62,775 unallotted.
Under the act approved Aug. 18, 1890.				
Under the act approved August 18, 1890, *making appropriations for fortifications and other works of defense*, for the armament thereof, for the procurement of heavy ordnance for trial and service, and for other purposes, were appropriated the following sums:				
To be expended under the direct supervision of the Board of Ordnance and Fortification, created by the fortification appropriation act approved September twenty-second, eighteen hundred and eighty-eight, and in the manner prescribed by said act, namely:				
Gun and mortar batteries: For construction of gun and mortar batteries for defense of Boston Harbor.	235,000.00	Sept. 2, 1890	235,000.00	
New York	726,000.00	....do	726,000.00	
San Francisco	260,000.00	....do	260,000.00	
For the procurement of land, or right pertaining thereto, needed for the site, location, construction or prosecution of works, for fortifications and coast defenses.	500,000.00	Oct. 24, 1891	500,000.00	
Armament of fortifications: For the manufacture (finishing and assembling) of eight-inch, ten-inch, and twelve-inch steel seacoast guns from forgings procured under fortification act of September twenty-second, eighteen hundred and eighty-eight.	70,000.00	May 6, 1891	70,000.00	

For completing the manufacture (finishing and assembling) of three and six-tenths-inch, five-inch, and seven-inch steel field and siege cannon from forgings procured under fortification act of March second, eighteen hundred and eighty-nine. Together with the unexpended balance of the appropriation of fourteen thousand dollars made for this object by the fortification appropriation act approved March second, eighteen hundred and eighty-nine.	36,000.00	Mar. 26, 1891	31,000.00	Balance $5,000 unallotted.
That contracts shall be invited by the Secretary of War by proper notice and publication for the manufacture (finishing and assembling) of eight-inch, ten-inch, and twelve-inch steel seacoast guns from forgings procured under fortification act of September twenty-second, eighteen hundred and eighty-eight, and if private parties shall offer to finish, assemble, and deliver any of such guns in proper condition for use as completed guns, at a price fair to the Government, the necessary contracts shall be entered into by the Secretary for that purpose, and to carry into effect this provision. *Provided*, That the finishing and assembling of not over fifty per centum of each caliber of such forgings shall be thus contracted for: *Provided further*, That all contracts made hereunder shall be so made as to fully protect the Government against all loss or damage which may result from imperfect work, the fault of the contractor, and the work done hereunder shall be subject to inspection at every stage.	200,000.00	Oct. 1, 1890 Nov. 8, 1890	500.00 65,000.00	Drawings, etc., $134,500 unallotted.
For steel field guns of three and two-tenths inch caliber	25,000.00	Sept. 2, 1890	25,000.00	
For breech-loading rifled seacoast mortars, cast iron, hooped with steel, of twelve-inch caliber. *Provided*, That contracts may be made for not more than one-fourth of the mortars herein provided for, to be constructed on the Pacific coast in the discretion of the Secretary of War.	400,000.00	....do	400,000.00	
For sights and implements for guns and for fuzes	2,000.00	....do	2,000.00	
For metallic carriages for field-gun batteries	143,135.00	Sept. 2, 1890	143,135.00	
For alteration of existing carriages for ten-inch and fifteen-inch smoothbore guns to adapt them to present service conditions.	100,000.00	....do	100,000.00	
For carriages for breech-loading rifled mortars of 12-inch caliber, procured under the fortification act of September twenty-second, eighteen hundred and eighty-eight.	225,000.00			$225,000 unallotted.
For powder for proving seacoast mortars of twelve-inch caliber, procured under the fortification act of September twenty-second, eighteen hundred and eighty-eight, and for testing projectiles.	10,000.00	Sept. 2, 1890	10,000.00	
For steel shell or shrapnel for field guns	12,000.00			$12,000 unallotted.
For cast-iron projectiles for field, siege, and seacoast guns, for issues to the service	24,500.00	Sept. 2, 1890	24,500.00	
For cast-iron projectiles for proving seacoast mortars of twelve-inch caliber, procured under the fortification act of September twenty-second, eighteen hundred and eighty-eight.	10,000.00	....do	10,000.00	
For steel shell for seacoast cannon	25,000.00	Sept. 3, 1890	25,000.00	
For steel armor-piercing projectiles for seacoast guns	100,000.00	Sept. 2, 1890	100,000.00	
For purchase and erection of armor plate for testing armor-piercing projectiles	24,000.00	Nov. 6, 1890	24,000.00	
Army Gun Factory: For machinery and plant for the manufacture of steel shell or shrapnel for field guns.	5,000.00			$5,000 unallotted.
For machinery to complete the full capacity of present Gun Factory building at Watervliet Arsenal, West Troy, New York.	165,000.00	Sept. 2, 1890	165,000.00	
For construction of a building for wash rooms, closets, and sinks for the operatives of the Gun Factory.	12,000.00	Sept. 5, 1890 Oct. 1, 1890	10,630.00 1,370.00	
For increase of machinery and plant for manufacture of projectiles, and for castings needed in current work of gun fabrication at Army Gun Factory.	16,000.00	Oct. 1, 1890	16,000.00	
For erection and completion of a fire-proof brick office building for the Army Gun Factory, Watervliet Arsenal, New York.	23,000.00	Oct. 4, 1890	23,000.00	The allotment of Oct. 4, 1890, was not approved until Sept. 3, 1891.

Appropriations made for the objects specified to be expended under the direct supervision of the Board—Continued.

Under the act approved Aug. 18, 1890.	Appropriated.	Allotments.		Remarks.
		Date.	Amount.	
For railroad sidings, switches, and weighing scale at the Army Gun Factory, Watervliet Arsenal, New York.	$2,800.00	Sept. 2, 1890	$2,800.00	
For one hundred and fifty horse power steam engine and shafting for machine shop at the Army Gun Factory, Watervliet Arsenal, New York.	3,500.00	....do	3,500.00	
For boring and turning lathes, rifling machine, and eighty-ton traveling-crane fully equipped for the manufacture of twelve-inch guns, at Watervliet Arsenal, New York.	320,000.00	....do	320,000.00	
That all material purchased under the foregoing provisions of this act shall be of American manufacture.				
That the President is hereby authorized to appoint a board to consist of three officers of the Army, one of engineers, one of artillery, and one of ordnance, not below the rank of lieutenant-colonel, who shall inquire into the facilities for producing steel forgings for high-power guns at or near the Pacific coast; and in the vicinity of the Rock Island Arsenal, and in the vicinity of the Indianapolis Arsenal, and at some point on or near the Gulf coast, and the advisability of erecting gun factories for finishing and assembling high-power guns, to be mounted in fortifications, at the Benicia Arsenal, in California, or at the Rock Island Arsenal, or at the Indianapolis Arsenal, or at some point on or near the Gulf coast.				
Said board shall also examine and report as to the capacity, cost of erection, and equipment of each of such gun factories.				
For the payment of the necessary expenses of said board	3,000.00	Oct. 1, 1890	3,000.00	
Board of Ordnance and Fortification: To enable the Board of Ordnance and Fortification to purchase abroad, for experimental purposes, such articles of foreign manufacture as are not produced in this country, and which are necessary in order that the Board may determine what may be best and worthy of adoption and manufacture in the United States.	100,000.00	.....	.....	$100,000 unallotted.
For the necessary expenses of the Board, as provided for in the last clause of section six of the act approved September twenty-second, eighteen hundred and eighty-eight.	5,000.00	Expended to Oct. 30, 1891.	567.50	4,432.50 unexpended.
To enable the necessary experiments to be made to test the value thereof, including the purchase of material and construction where necessary, of pneumatic gun carriages, segmental guns, and high explosives.	50,000.00	May 6, 1891 July 21, 1891 Oct. 24, 1891	3,031.00 125.00 18,912.50	27,931.50 unallotted.
SEC. 2. That the Secretary of War is hereby authorized and directed to purchase under contract, after due advertisement inviting proposals, and at prices which the Board of Ordnance and Fortification shall adjudge to be fair to the manufacturer and for the interest of the United States, twenty-five eight-inch, fifty ten-inch, and twenty-five twelve-inch guns, all of which guns shall be breech-loading single-charge steel guns, and of weight and dimensions to be prescribed by the Board, and shall fulfill the conditions hereinafter provided: *Provided*, That if two or more persons, citizens of the United States, submit proposals to furnish said guns, either in part or in whole, at prices not materially different from each other, contracts may be awarded, in such proportion, among the citizens submitting such proposals as the Secretary of War may direct. One type gun of each of the above-mentioned caliber, with the proper supply of ammunition therefor, shall be presented for test at such place and within such time as the contract shall provide, and shall be subjected to such tests in respect to accuracy, range, power, endurance, and general efficiency as the Board of Ordnance and Fortifica-				

tion shall have prescribed. All the other guns of each caliber, with the proper supply of ammunition, shall be delivered at such place and within such times as the contract shall provide, and shall be subjected to the ordinary service test of ten rounds with the full charge and weight of projectile, which shall develop the standard power prescribed for the gun. If the type gun sustains the prescribed test to the satisfaction of the Board of Ordnance and Fortification, it and each of the other guns which sustains the ordinary service test, and the ammunition expended in such tests, shall be accepted under the contract. All guns manufactured under these contracts, including the type guns, shall be subjected to inspection at all stages of manufacture, and no change whatever shall be made in the material, mode of manufacture, or dimensions of the guns for service from those employed in the type gun without the approval of the Secretary of War. Payment for each gun and ammunition for testing same, including cost of transportation, shall be made upon the satisfactory completion of the prescribed test for that gun. All tests of guns shall be made in the presence of the Board and of the person presenting the gun, or his authorized agent, and due regard shall be paid to suggestions offered by him which respect the mode of making such test.

That under the provisions of this section there shall not be expended or contract or contracts entered into involving the Government in an aggregate expenditure exceeding three million seven hundred and seventy-five thousand dollars, nor an expenditure on the part of the Government in any one fiscal year in excess of one million dollars. And all guns and materials purchased under the authority of this section shall be of American manufacture and furnished by citizens of the United States: *Provided further*, That contracts may be made for not exceeding one-fourth of the guns herein provided for, to be constructed on the Pacific coast, in the discretion of the Secretary of War: *Provided further*, That all expenditures made under this section shall be paid from the amount made available and provided for in section six of the "Act making appropriations for fortifications and other works of defense, for the armament thereof, for the procurement of heavy ordnance for trial and service, and for other purposes," approved September twenty-second, eighteen hundred and eighty-eight, and the Secretary of War shall embrace in his estimates of appropriations for fortifications from time to time the amounts necessary to carry out all contracts made hereunder: *Provided further*, That full and accurate accounts shall be kept, showing the cost of all type and experimental manufacture of guns, and other articles, and the average cost of the several classes of guns and the other articles manufactured by the Government a statement of which account shall be laid before Congress annually in the same manner as is now required from national armories under section sixteen hundred and sixty-five of the Revised Statutes.

Total	**3,832,935.00**		**3,319,071.00**	**Balance, $513,864.**

Under the act approved Feb. 24, 1891.

Under the act approved **February 24, 1891**, ***making appropriations for fortifications and other works of defense***, for the armament thereof, for the procurement of heavy ordnance for trial and service, and for other purposes, were appropriated the following sums, to be expended under the direct supervision of the Board of Ordnance and Fortification, created by the fortification appropriation act, approved September twenty-second, eighteen hundred and eighty-eight, and in the manner prescribed by said act, namely:

Armament of fortifications: For the manufacture (finishing and assembling) of eight-inch, ten-inch, and twelve-inch steel seacoast guns from forgings procured under fortification act of September twenty-second, eighteen hundred and eighty-eight.	70,000.00	Mar. 25, 1891	70,000.00	
For steel field guns of three and two tenths inch caliber	25,000.00	....do	25,000.00	
For metallic carriages for field-gun batteries	61,000.00	....do	61,000.00	

Appropriations made for the objects specified to be expended under the direct supervision of the Board—Continued.

Under the act approved Feb. 24, 1891.	Appropriated.	Allotments.		Remarks.
		Date.	Amount.	
For carriages for field mortars of three and six-tenths inch caliber	$5,760.00	Mar. 26, 1891	$5,760.00	
For carriages for siege rifles of five-inch caliber	30,000.00	Sept. 22, 1891	30,000	
For carriages for siege howitzers of seven-inch caliber	35,000.00			$35,000 unalloted.
For alteration of existing carriages for ten-inch and fifteen-inch smooth-bore guns to adapt them to present service conditions.	50,000.00	Mar. 25, 1891	50,000.00	
For machines, and for improvement of existing plant at the Watertown Arsenal, Massachusetts, for the manufacture of seacoast gun carriages, including those of new design.	27,000.00	....do	27,000.00	
For sights and implements for guns and for fuses	6,000.00	....do	6,000.00	
For machinery and tools for the manufacture of fuses at Frankford Arsenal, Pennsylvania.	8,500.00	....do	8,500,00	
For inspecting instruments, gauges, and templets, for the manufacture of cannon	5,000.00	....do	5,000.00	
For powders for issues to the service, namely: For siege guns; for seacoast mortars of twelve-inch caliber; for seacoast high-power steel guns; in all.	40,000.00	....do	40,000.00	
For projectiles for issues to the service, namely: For steel shell or shrapnel for field guns; for cast-iron projectiles for field and siege guns; for cast-iron projectiles for seacoast mortars of twelve-inch caliber; for cast-iron projectiles for seacoast high-power steel guns; in all.	53,000.00	....do	53,000.00	
For steel shell for siege and seacoast cannon	15,000.00	....do	15,000.00	
For purchase and erection of steel plates for representative experiments upon armored decks.	12,000.00	....do	12,000.00	
For steel armor-piercing projectiles for seacoast guns	100,000.00	....do	100,000.00	
For purchase and erection of armor plate for testing armor-piercing projectiles	24,000.00	....do	24,000.00	
For testing one seacoast breech-loading rifled mortar, steel, of twelve-inch caliber	15,000.00	....do	15,000.00	
For current expenses and maintenance of the ordnance proving ground, Sandy Hook, New Jersey, including general repairs, alterations, and accessories, and including a crane, incidental to testing and proving ordnance, including hire of assistants for Ordnance Board, skilled mechanical labor, purchase of instruments and other supplies, building and repairing butts and targets, clearing and grading ranges, and extending iron tramway.	38,400.00	Mar. 25, 1891	38,400.00	
For the necessary expenses of ordnance officers while temporarily employed at the proving ground and absent from their proper stations, at the rate of two dollars and fifty cents per diem while so employed, and for the compensation of draughtsmen while employed in the Army Ordnance Bureau on ordnance construction, as provided in the fortifications act approved September twenty-second, eighteen hundred and eighty-eight.	9,500.00	May 6, 1891	9,500.00	
For purchase of hoisting engine and steam shovel for grading, and for building and repairing proof butts at the proving ground, Sandy Hook, New Jersey.	3,800.00	....do	3,800.00	
For purchase of oil-tempered and annealed steel for high-power coast-defense guns of eight, ten, and twelve inch caliber, in quality and dimensions conforming to specifications, subject to inspection at each stage of the manufacture, and including all the parts of each caliber. *Provided*, That no contract for the expenditure of any portion of the money herein provided, or that may be hereafter provided, for the purchase of steel shall be made until	800,000.00	Mar. 25, 1891	800,000.00	

the same shall have been submitted to public competition by the Department by advertisement.				
For carriages for steel breech-loading seacoast guns, procured under the fortification act of September twenty-second, eighteen hundred and eighty-eight.	100,000.00	Mar. 26, 1891	35,000.00	$65,000 unallotted.
For two gun carriages of the disappearing type: Together with the sum of thirteen thousand five hundred dollars appropriated for one ten-inch disappearing gun carriage by the act of March second, eighteen hundred and eighty-nine, which sum is hereby reappropriated for the object herein mentioned.	56,500.00	May 6, 1891	56,500.00	Of the $70,000 allotted May 6, 1891, $13,500 is under fortification act approved March 2, 1889, and has been placed as an allotment under that act.
Army Gun Factory, Watervliet Arsenal, West Troy, New York: For boring lathe and planer adapted to the manufacture of siege guns and howitzers in small gun shop at the Army Gun Factory.	4,100.00	Mar. 25, 1891	4,100.00	
To complete Army Gun Factory building at Watervliet Arsenal, West Troy, New York, by the erection of south wing, inclusive of ways for traveling cranes.	248,743.00	....do	248,743.00	
For machinery, tools, power plant, and fixtures adapted to the manufacture of steel seacoast guns, to complete the equipment of the south wing of Army Gun Factory at Watervliet Arsenal, West Troy, New York.	268,000.00	....do	268,000.00	
For iron framework, with adjustable platforms and centers for fitting up shrinkage pit, and for drainage of shrinkage pit at Army Gun Factory.	14,000.00	....do	14,000.00	
For locomotive and cars or trucks for shifting guns and material and transportation between gun factory and river wharf.	9,000.00	....do	9,000.00	
For increase of facilities at Watervliet Arsenal for shipment by water, including repairs to wharf, dredging, and extending and setting up fifty-ton hand-power loading crane.	6,500.00	....do	6,500.00	
Board of Ordnance and Fortification: To enable the Board to make all needful and proper purchases, experiments, and tests to ascertain, with a view to their utilization by the Government, the most effective guns, small arms, cartridges, projectiles, fuses, explosives, torpedoes, armor plates, and other implements and engines of war, and to purchase, or cause to be manufactured under authority of the Secretary of War, such guns, carriages, armor plates, and other war materials and articles as may, in the judgment of the Board, be necessary in the proper discharge of the duty devolved upon it by the act approved September twenty-second, eighteen hundred and eighty-eight.	150,000.00	{May 5, 8, 1891 {Oct. 21, 1891	97,150.00 2,500.00	} Balance, $50,350, unallotted.
Total	2,290,803.00	.....	2,140,453.00	Balance, $150,350, unallotted.

Appropriations made for the objects specified to be expended under the direct supervision of the Board—Continued.

SUMMARY TO OCTOBER 30, 1891.

Act.	Total appropriations.	Total allotments, expenditures, and reverting to Treasury.	Total balances on hand not allotted or expended.	Remarks.
Fortification, Sept. 22, 1888	$3,972,000.00	$3,889,245.76	$72,754.24	The expenditures for which no formal allotments were made, but which were paid by the disbursing officer of the Board (the recorder), on vouchers approved by the president of the Board, were $556.20 selecting site for ordnance proving grounds, and $5,567.50 personal expenses of members of the Board, pay of clerk and stenographer, and messenger, stationery, miscellaneous supplies, office furniture, and express charges.
Army appropriation, Mar. 2, 1889	56,000.00	3,156.20 52,843.80		
Fortification, Mar. 2, 1889	1,233,594.00	1,170,819.00	62,775.00	
Fortification, Aug. 18, 1890	3,832,935.20	3,319,071.00	513,864.00	
Fortification, Feb. 24, 1891	2,290,303.00	2,140,453.00	150,350.00	
Grand totals	11,385,332.00	10,585,588.76	779,743.24	

Total allotments	$10,526,625.26
Total expenditures without regular allotments	6,123.70
Total turned into Treasury	443.80
Total reverting to Treasury by lapse of appropriation	52,400.00
Total	10,585,588.76

Appendix B.

SPECIFICATIONS GOVERNING THE MANUFACTURE AND INSPECTION OF STEEL FOR CANNON, PRESCRIBED BY THE ORDNANCE DEPARTMENT, U. S. ARMY.

PART I.—GENERAL SPECIFICATIONS.

1. Metal.

The metal used shall be low steel, melted by the open-hearth process, and cast into suitable ingots at the works of the contractor. For special purposes and for some small parts crucible steel shall be used when required.

2. Marking forgings during manufacture.

The manufacturers shall devise and use plans for marking forgings, pieces for forgings cut from ingots, etc., which shall determine with certainty that end or part of the forging, piece, etc., which was nearest to the top of the ingot as cast, and in case more than one piece is cut from any one ingot, the relative positions of the several pieces in the ingot, and which shall in all cases assure the identification of the forging, piece, etc., with the ingot from which it was made or cut. They shall also determine with certainty the weight of metal cut from the top and from the bottom of each ingot used.

3. Condition of material when delivered.

All the forgings shall be rough finished, except when, for some parts of breech mechanism, it is specifically stipulated that smooth forgings are required; they shall conform strictly to the dimensions shown on the drawings accompanying the contract. The United States requires sound and reliable material, and the pieces shall be free from seams, cracks, sand, slag, folds, or other defects.

4. Allowance of metal for tests.

The manufacturers shall always allow, without cost to the United States, sufficient additional length or size to the pieces to furnish the test specimens required. If no particular part of the piece is designated for the specimens, the instructions of the senior inspector shall be followed.

5. Metal for manufacturers' tests.

Any metal required by the manufacturers for their own mechanical tests at the various stages of manufacture shall be provided for in additional length or size of the pieces over that required by the United States for the tests of acceptance, and in no case, unless by special authorization of the senior inspector, shall the manufacturers use for their own tests any of the metal or length of piece required by the United States.

6. Test of specimens.

If the manufacturers possess a reliable testing machine, and if the results obtained with such testing machine are found to be comparable with those obtained with the United States testing machine at Watertown Arsenal, then the Gov-

[illegible]

[illegible]

[illegible]

If the manufacturers desire to present additional specimens they shall, within three days from the date they are informed of nonacceptance, notify the senior inspector to that effect. If such notification is not received within that time, or if the manufacturers are informed they can not re-treat or retest the piece, they shall proceed to replace it.

If a piece is finally rejected at the manufacturers' works on account of unsatisfactory physical qualities or dimensions, or on account of defects, or at any time after delivery on account of defects, then the manufacturers shall be allowed six months in the case of tubes and jackets for cannon of 8 inches caliber and upwards; four months in the case of trunnion hoops for cannon of over 8 inches in caliber, and also in the case of tubes and jackets for cannon below 8 inches in caliber, excepting field calibers; three months in the case of tubes for field calibers, and trunnion hoops for cannon of 8 inch caliber, and two months in the case of all other pieces, from the date of notification of rejection, in which to replace the rejected piece, and to present the first set of specimens from the new piece.

14. Use of rejected pieces.

Pieces which are rejected may with the approval of the senior inspector be used for other pieces of smaller dimensions, but such smaller pieces made from a rejected piece must always be subjected to the prescribed tests.

15. Additional specimens required.

Any special additional test specimens required by the United States for information or experiment shall be furnished by the manufacturers at actual cost of labor of preparation, with 10 per centum added for profit, and to cover wear, etc., of tools.

16. Board to determine the gravity of defects.

If a piece is condemned at any time for defects the manufacturers may, with the approval of the Department, submit the piece for the inspection of a board of three officers of the Ordnance Department, and the decision of said board, subject to the approval of the Chief of Ordnance, shall govern as to its acceptance or rejection; and the manufacturers may have a representative appear before said board.

If any piece is finally rejected by said board, or if the manufacturers acknowledging the gravity of the defect submit to the decision of the condemning inspector, then, if the piece has been shipped by the United States from the manufacturers' works, the manufacturers shall pay the cost of shipping the rejected piece back to their works if they desire it shipped back, and they shall prepay the cost of shipping a piece made to replace the rejected piece to the place of rejection.

17. Changes in drawings.

The dimensions shown on the drawings accompanying contracts shall be always subject to such changes as the United States may deem advisable, which do not materially affect the cost of manufacture per pound, or do not decrease the percentage of profit to the manufacturers; and any changes which do materially affect the cost of manufacture per pound, or do decrease the percentage of profit to the manufacturers, shall be paid for at a fair price to be determined by the contracting parties.

18. Payments.

When contracts require the delivery of pieces for the fabrication of more than one kind or caliber of cannon, or more than one set of pieces for a particular caliber, then payment for each set of pieces for each kind or caliber, or for each set for a particular caliber, shall be made the manufacturers on the delivery of each set of pieces, complete, less 5 per centum to be retained by the United States until the completion of the whole contract, or of all the pieces for a particular caliber.

Payments shall be made on bills approved by the proper officers in the manner prescribed by law and regulations.

19. Limiting of service.

A contract for the manufacture of material for cannon shall be considered complete as to the quantity of the service to be covered only when all the pieces of the lot under such contract have been so far machine-finished as to prevent the possibility of the final rejection of any one of said pieces.

20. Drawings and blank forms.

All necessary drawings shall be provided by the manufacturers, and any copies of drawings furnished by the United States, or any working drawings made by the manufacturers, shall be approved by the senior inspector before they are issued for use at the works. All drawings furnished by the United States shall be considered confidential, and for the use of the manufacturers in the prosecution of the Government work only. All blank forms which may be necessary for the expedition in manufacture of the material, or to facilitate the transaction of business between the senior inspector and the manufacturers, shall be furnished by the manufacturers.

21. Inspection of the manufacture.

The manufacture of material for ordnance constructions shall be open to inspection in all its details by the officers and employés of the Ordnance Department assigned to duty for that purpose, and shall receive the approval of the senior inspector at the works, or such one of his assistants as he may designate, at all its stages.

22. Information and assistance to be given inspectors.

That the requirements of paragraph 21 may be carried out, the manufacturers shall, before commencing the work under any order or contract, inform the senior inspector of their general plans; and during the progress of the work they shall inform him of the chemical composition of each and every ingot, part of ingot or casting, which they propose to use, together with a statement of its casting, size, and condition; they shall inform him, or such of his assistants as he may designate, of the time at which each operation connected, either directly or indirectly, with the manufacture is to take place, and shall give him such notification as may be required to insure his witnessing any particular part of an operation which he may specify; they shall furnish him with a copy of the results of all chemical analyses and mechancial tests made at their works upon any piece under fabrication or in any way connected with the material to be furnished; they shall provide all necessary labor, and allow the use of the necessary tools and implements for the assistance of the senior inspector and his assistants in the performance of any of their duties, and they shall provide within their works suitable and satisfactory office room for instruments, drawings, books, etc., which may be used exclusively by the senior inspector and his assistants.

The officers and employés referred to in paragraph 21 shall have free access at all times to all parts of the manufacturers' works. The details of the operations carried on at the works will be considered confidential so far as the manufacturers may desire.

PART II.—FOR TUBES AND JACKETS.

1. Size of ingot.

Ingots for tubes shall have an area of cross-section in that part of the ingot used for the tube forging at least four times as great as the maximum area of cross-section of the rough forging, except that for tubes for cannon of 12 inches caliber and upward the area of cross-section of that part of the ingot used for the tube forging shall be at least three and one-half times as great as the maximum area of cross section of the rough forging; the ingots for jackets shall have an area of cross section in that part of the ingot used for the jacket forging at least three and one-half times as great as the maximum area of cross-section of the rough forging, except that for jackets for cannon of 12 inches caliber and upward the area of cross-section of that part of the ingot used for the jacket forging shall at least three times as great as the maximum area of cross-section of the rough

forging; and the ingots for lining tubes shall have an area of cross-section in that part of the ingot used for the lining-tube forging at least six times as great as the maximum area of cross-section of the rough forging. If bored ingots are used then the wall of the ingot shall be reduced by forging at least as much as to one-half of its original thickness.

2. Part of ingot to be used.

Only so much of any ingot shall be used for tubes and jackets as shall remain after at least 6 per centum of the total weight of the ingot has been cut from the bottom of the ingot, and at least 30 per centum from the top.

3. Sizes of rough forgings.

Rough forgings shall have only such allowance of metal over the diameters required in the rough-finished piece as will insure the removal of all surface imperfections in rough finishing.

4. Treatment.

Tubes and jackets shall, if desired by the United States, be annealed at high heat either after forging or after rough finishing, and before oil-tempering. This heat will be at least as high as that at which the pieces are subsequently to be heated for oil-tempering.

The pieces shall, after rough boring and turning, be oil-tempered and subsequently annealed or tempered at a lower temperature than that of the previons operation.

5. Oil-tempering.

Tubes and jackets shall generally be heated for oil-tempering vertically, and as evenly as possible; shall be immersed in the tempering fluid in the direction of their axes in such manner and with such arrangement that a current of the fluid will flow through the bore, and the operation shall always be performed on the whole of the piece, never on a part only.

6. Annealing after oil-tempering.

Tubes and jackets shall be heated for annealing as evenly as possible, and the operation shall always be performed on the whole of the piece, never on a part only; but if it be necessary, from the conditions in any case, to vary the degree of the heat at the ends, this variation must be uniform from one end to the other.

Every operation of tempering or annealing must be withessed by the senior inspector or such of his assistants as he may designate, and if unsatisfactory in any way retempering or reannealing shall be ordered in his discretion.

7. Straightening.

When after treatment pieces are found to be bent or warped to such an extent as to render straightening under the press or hammer necessary, they shall be heated for this operation, and the straightening shall be followed by re-treatment. Tubes and jackets when delivered shall be straight and true, free from warp or bend, the exterior being truly concentric with the bore.

8. Number, form, and position of test specimens.

The stem of all test specimens shall, if possible, be taken within the finished interior and exterior surfaces of the piece prolonged.

Tangential test specimens shall be furnished from each tube and jacket as specified in the following table, No. I:

Table No. I.

Caliber of cannon.	Designation of piece.	Kind of test specimen.	Number of specimens from—		Size of specimens.		Minimum distance of axis from end of forging.
			Breech end.	Muzzle end.	Length of stem.	Diameter of stem.	
					Inches.	*Inches.*	*Inches.*
Field cannon of all calibers	Tube	Tensile	2	2	2.0	0.505	1.15
	Jacket	do	2	or 2	2.0	0.505	1.15
Siege cannon of all calibers	Tube	do	2	2	3.0	0.564	1.25
	Jacket	do	3	3	3.0	0.564	1.25
Seacoast cannon of 8-inch caliber and upward to 12-inch caliber.	Tube	do	3	3	3.0	0.564	1.50
	Jacket	do	4	4	3.0	0.564	1.50
Seacoast cannon of 12-inch caliber and over.	Tube	do	4	4	3.0	0.564	1.50
	Jacket	do	4	4	3.0	0.564	1.50

All with screw-ends as required.

9. Physical qualities.

Each of the test specimens should show the physical qualities given in the following table, No. II, which the manufacturer shall aim to obtain:

Table No. II.

Caliber of cannon.	Designation of piece.	Elastic limit.	Tensile strength.	Elongation after rupture.
		Lbs. per sq. inch.	*Lbs. per sq. inch.*	*Per cent.*
Field cannon of all calibers	Tube	46,000	86,000	22.0
	Jacket	50,000	93,000	19.0
Siege cannon of all calibers	Tube	46.000	86,000	20.0
	Jacket	50,000	93,000	18.0
Seacoast cannon of 8-inch caliber	Tube	46,000	86,000	19.0
	Jacket	50,000	93,000	17.0
Seacoast cannon of 10-inch caliber and over	Tube	46,000	86,000	19.0
	Jacket	48,000	90,000	17.0

The forgings shall, however, be accepted as to physical qualities provided no one of the specimens shows results in any particular below the figures given in the following table, No. III:

Table No. III.

Caliber of cannon.	Designation of piece.	Elastic limit.	Tensile strength.	Elongation after rupture.	Contraction of area.
		Lbs. per sq. inch.	*Lbs. per sq. inch.*	*Per cent.*	*Per cent.*
Field cannon of all calibers	Tube	42,000	78,000	20.0	25.0
	Jacket	46,000	86,000	17.0	30.0
Siege cannon of all calibers	Tube	42,000	78,000	18.0	30.0
	Jacket	46,000	86,000	16.0	27.0
Seacoast cannon of 8-inch caliber	Tube	42,000	78,000	17.0	30.0
	Jacket	46,000	85,000	16.0	27.0
Seacoast cannon of 10-inch caliber and over.	Tube	42,000	78,000	17.0	30.0
	Jacket	44,000	83,000	16.0	27.0

›t that for the calibers and pieces enumerated below one, and only one, ı from each end may be in any one particular lower in its qualitities than

the figures given in table No. III, but must not be in that particular lower thar the figures given in the following table, No. IV:

Table No. IV.

Caliber of cannon.	Designation of piece.	Elastic limit.	Tensile strength.	Elongation after rupture.	Contraction of area.
		Lbs. per sq. inch.	*Lbs. per sq. inch.*	*Per cent.*	*Per cent.*
Seacoast cannon of 8-inch caliber.	Jacket	44,000	83,000	14.0	22.0
Seacoast cannon of 10-inch caliber and over.	Tube	40,000	75,000	15.0	25.0
	Jacket	42,000	80,000	13.5	20.0

In addition to the tensile tests prescribed, the tubes and jackets shall be submitted to a powder test or percussive hydraulic test if desired by the United States, with an interior pressure a little (about 1,000 pounds) less than their elastic resistance. No weakness or defect should be developed by these tests, and the manufacturers shall detach rings for mandril or initial tension tests when in special cases they are notified that such rings are desired.

These additional tests will be made under the supervision of the Ordnance Department, and any extra expense incurred by the manufacturers will be paid for as provided in paragraph 15, Part I.

10. *Re-testing.*

If the piece fails to fill the physical requirements of these specifications at either or both ends, an additional set or sets of specimens may be submitted for test, but in such case no one specimen should show results below the figures given in table No. III. If a piece fails to fill the requirements on this second presentation it shall be finally rejected, except when the senior inspector may recommend and the Chief of Ordnance authorize further testing.

11. *Re-treatment.*

When a piece fails to fill the physicial requirements of these specifications and the manufacturers re-anneal or re-temper and re-anneal it, complete tests of both ends shall be made, and the previous tests shall not be considered in deciding upon the acceptance or rejection of the piece.

PART III.—FOR HOOPS.

1. Part of ingot to be used.

Only so much of any ingot shall be used for hoops as shall remain after at least 5 per cent of the total weight of the ingot has been cut from the bottom of the ingot and at least 28 per centum from the top.

2. Size of forgings.

Cylindrical hoops may be either forged or rolled, but will be rolled whenever practicable. The allowance of metal over the rough-finished diameters shall be as slight as possible, especially if the hoops are to be treated as they come from the forge or rolls, and without being machined.

The inspector shall, in his discretion, require the reworking of any hoop on which there is an excessive allowance of metal in any part or throughout, or shall require the removal of the surplus metal by machining.

Trunnion hoops shall vary as little as possible from the rough-finished diameters, and especially the rough-finished dimensions in the vicinity of the rim bases, and any surplus metal shall be removed before treatment.

3. Treatment.

All hoops shall, if desired by the United States, be annealed at a high heat before oil-tempering. This heat will be at least as high as that at which the hoops are to be subsequently oil-tempered. The hoops shall then be oil-tempered and subsequently annealed or tempered at a lower temperature than that of the previous operation.

4. Oil-tempering.

All hoops shall be heated for oil-tempering as evenly as possible, and shall be immersed in the tempering fluid in the direction of their axes, and the operation shall be performed on the whole of the piece, never on a part only.

5. Annealing after oil-tempering.

All hoops shall be heated for annealing as evenly as possible, and the operation shall always be performed on the whole of the piece, never on a part only.

Every operation of tempering or annealing must be witnessed by the inspector, or such of his assistants as he may designate, and if unsatisfactory in any way, re-tempering or re-annealing shall be ordered in his discretion.

6. Representative treatment.

Whenever the treatment to which hoops are subjected is to be representative, *i. e.*, when two or more hoops are treated together in the final annealing and all are not to be tested, then that operation must be witnessed by the inspector or one of his assistants, or the test made of one hoop will not be taken to represent the other or others, and in all such cases of representative treatment the proposed disposition of the hoops for treatment must receive the approval of the inspector before the operation is commenced.

7. Number, position, and form of test specimens.

The stem of all test specimens shall, if possible, be taken within the finished interior and exterior surfaces of the hoop prolonged.

Tangential test specimens shall be furnished from each trunnion hoop, as specified in the following table, No. V.

Table No. V.

Caliber of cannon.	Number of test specimens.		Size of specimens.		Minimum distance of axis from end of hoop.
	Breech end.	Muzzle end.	Length of stem.	Diameter of stem.	
			Inches.	*Inches.*	*Inches.*
Field cannon of all calibers	2 or	2	2.0	0.505	1.15
Siege-cannon of all calibers	3 or	3	3.0	0.564	1.25
Seacoast guns of 8 inches caliber and over	4 or	4	4.0	0.564	1.25
Mortars of 8 inches caliber and over	3 or	3	4.0	0.564	1.25

All with screw ends, as required.

Tangential test specimens shall be furnished from cylindrical hoops, as specified in the following table, No. VI.

Table No. VI.

Rough-finished size of hoops.	Number of test specimens.			Size of specimens.		Minimum distance of axis from end of hoop.
	From breech end.	From muzzle end.	From hoop.	Length of stem.	Diameter of stem.	
				Inches.	*Inches.*	*Inches.*
Not more than 8 inches inside diameter. Not more than 30 inches long.	.....	.....	1	2.0	0.505	1.15
Not more than 8 inches inside diameter. More than 30 inches long.	1	1	.....	2.0	0.505	1.15
More than 8 inches inside diameter. Not more than 16 inches inside diameter. Not more than 30 inches long.	.....	.....	2	3.0	0.564	1.25
More than 8 inches inside diameter. Not more than 16 inches inside diameter. More than 30 inches long.	2	2	.....	3.0	0.564	1.25
More than 16 inches inside diameter. Not more than 34 inches inside diameter. Not more than 26 inches long.	.....	.....	3	4.0	0.564	1.25
More than 16 inches inside diameter. Not more than 34 inches inside diameter. More than 26 inches long.	3	3	.....	4.0	0.564	1.25
re than 34 inches inside diameter. ot more than 25 inches long.	.....	.....	4	4.0	0.564	1.25
e than 44 inches inside diameter. ore than 25 inches long.	4	4	.....	4.0	0.564	1.25

ll with screw ends, as required.

8. Physical qualities.

The test specimens should show the mean physical qualities given in the following table, No. VII, as a minimum.

Table No. VII.

Size of specimens.		Elastic limit.	Tensile strength.	Elongation after rupture.
Length of stem.	Diameter. of stem.			
FOR TRUNNION HOOPS.				
Inches.	*Inches.*	*Lbs. per sq. inch.*	*Lbs. per sq. inch.*	*Per cent.*
2.0	0.505	50,000	90,000	18.0
3.0	0.564	50,000	90,000	15.0
4.0	0.564	50,000	90,000	13.0
FOR CYLINDRICAL HOOPS.				
2.0	0.505	50,000	90,000	18.0
3.0	0.564	53,000	93,000	15.0
4.0	0.564	53,000	93,000	13.0

Provided, that for trunnion hoops one specimen may be, in any one particular, below the figures given in Table No. VII, but not lower than 48,000 pounds per square inch in elastic limit, 88,000 pounds per square inch in tensile strength, or 1 per cent less than given in elongation after rupture; and provided further, that for cylindrical hoops, when three or four specimens are taken, one of these specimens, or one from each end, and no more, may be, in any one particular, below the figures given in Table No. VII, but not lower than 50,000 pounds per square inch in elastic limit, 90,000 pounds per square inch in tensile strength, or 12 per cent in elongation after rupture.

But for cylindrical hoops the inspector may arrange with the manufacturer, before any work is done, to make the treatment representative when more than one hoop is made from an ingot; provided, that at least one-half of the total number of hoops made from any one ingot shall be tested, and that the inspector shall designate which one or ones of the hoops shall be tested. In case of such representative treatment the rejection of the tested hoop shall carry with it the rejection of the hoop or hoops represented by such tests, unless it shall happen that there be on a non-tested hoop sufficient extra metal to allow its test to the satisfaction of the inspector, in which case the non-tested hoop shall be tested, and its acceptance or rejection shall depend on the results of test of the specimens taken from it. The inspector shall from time to time require a specimen or specimens, not exceeding the number required for such hoops, to be taken from any nontested hoop and nontested end of trunnion hoops, to judge of the uniformity of treatment.

9. Re-testing.

If any hoop fails to fill the physical requirements of these specifications at either or both ends, an additional set or sets of specimens, or a number less than originally required, in the discretion of the inspector, may be submitted for test, in which case the set or sets of specimens must fill the requirements as to physical qualities, and each of the reduced number of specimens must show qualities as high as the mean qualities required. A hoop failing to pass on the submission of additional specimens shall be finally rejected, except where the senior inspector recommends and the Chief of Ordnance authorizes further testing.

10. Re-treatment.

When a hoop fails to fill the physical requirements of these specifications and the manufacturers re-anneal or re-temper and re-anneal it, complete tests shall be made of one or both ends, as the case may be. Representative re-treatment shall

be conducted under the conditions, restrictions, and limitations prescribed for original representative treatment.

11. Definition of hoop.

The term cylindrical hoop used in these specifications shall be construed to mean all those forgings which are to be used over a tube or jacket in constructing a gun, by whatever name they may be designated, either as hoop, ring, sleeve, etc,, and also all bushings for the breech.

PART IV.—FOR PARTS OF BREECH MECHANISM.

1. Part of ingots to be used.

Only so much of any ingot shall be used for breech-mechanism forgings as shall remain after at least 5 per cent of the total weight of the ingot has been cut from the bottom of the ingot and at least 28 per cent from the top.

2. Size of forgings.

Parts of breech mechanism, excepting those expressly required as smooth forgings, shall be rough-finished before treatment; but the inspector may, in his discretion, if the conditions warrant it, waive this requirement entirely, or may only require the removal of any excessive allowance of metal, in places, by machining; parts, however, which are to be used and which are shown on the drawings bored or pierced, shall always be bored or pierced before treatment.

3. Treatment.

Parts of breech mechanism, or such of them as may be desired by the United States, shall be annealed at a high heat before oil-tempering. This heat will be at least as high as that at which the parts are to be subsequently oil-tempered. The parts shall then be oil-tempered and subsequently annealed or tempered at lower temperature than that of the previous operation.

4. Oil-tempering.

Parts of breech mechanism shall be heated for oil-tempering as evenly as possible and immersed in the tempering fluid as required; the operation shall always be performed on the whole of the piece, never on a part only.

5. Annealing after oil-tempering.

Parts of breech mechanism shall be heated for annealing as evenly as possible, and the operation shall always be performed on the whole of the piece, never on a part only.

Every operation of tempering and annealing must be witnessed by the inspector or such of his assistants as he may designate, and if unsatisfactory in any way, re-tempering or re-annealing shall be ordered, in his discretion.

6. Representative treatment.

The parts of breech mechanism of the same kind made from the same ingot shall, as much as possible, be treated together, and specimens for test taken from one or more of the pieces to represent the whole, as specified in Table No. VIII. Every operation of this kind must be witnessed by the inspector or one of his assistants, or the tests of one piece will not be taken to represent the other or others not tested, and in all such cases the proposed disposition of the pieces for the final annealing must be approved by the inspector before the operation is commenced.

The acceptance or rejection of the tested piece shall, in such case, carry with it the acceptance or rejection of all the other pieces represented by such tests, that in case of non-acceptance or rejection, when there happens to be on he other pieces sufficient metal to allow its being tested to the satisfac- he inspector, it shall be tested and passed upon separately, or in case e several pieces represented and no extra metal for test specimens,

one or more of these pieces may be cut up for test to represent the remaining ones, if satisfactory to the inspector. In all cases of representative treatment the manufacturers shall arrange with the inspector the details of the fabrication, and the inspector shall designate which one or ones of the pieces shall be tested.

7. *Number, position, and form of test specimens.*

The stem of all specimens shall, if possible, be taken within the finished exterior and interior surfaces of the piece prolonged, or otherwise they shall be taken just outside the rough-finished lines of the piece; the axis shall, if possible, always be at least 3 inches from axis of the forging.

Test specimens shall be furnished from parts of breech mechanism as specified in the following table, No. VIII.

Table No. VIII.

Name of part.	Caliber of cannon.			Size of specimen.		Minimum distance of axes from end of piece.
	Field cannon of all calibers.	Siege-cannon of all calibers.	Seacoast cannon of 8 inches caliber or over.	Length of stem.	Diameter of stem.	
				Inches.	*Inches.*	*Inches.*
Breech block	One from every fifth.	One from every third.		2.0	0.505	1.15
			Two from every second.	3.0	0.564	1.25
Spindle	One from stem of every fifth.	One from stem of every third.		2.0	0.505	
			Two from head of every second.	3.0	0.564	1.25
Lever handles, breech plates and face plates.	One from every twelfth.	One from every fifth.		2.0	0.505	
			One from every second.	3.0	0.564	
Gas-check cups and gas-check rings.	One from one additional forging for test. To be made for each 10.	One from one additional forging for test. To be made for each 6.		2.0	0.505	0.50
			Two from one additional forging for test. To be made for each 4.	3.0	0.564	0.75
Block-carriers	One from every twelfth.	One from every third.		2.0	0.505	0.75
Hinge pins, rollers, and bars for securing pins.	One from one additional forging for test. To be made for each 25.	One from every fifth.		2.0	0.505	
			One for every third.	3.0	0.564	

All with screwends, as required.

When one (or more) specimen is required from each ten (or other number of) forgings, one specimen will also be required for any less number of forgings, and at least one forging from each ingot and kind of forging shall be tested.

8. Physical qualities.

The test specimens must show the physical qualities given in the following table, No. IX, as a minimum:

Table No. IX.

Name of part.	Size of specimens.		Elastic limit.	Tensile strength.	Elongation after rupture.
	Length of stem.	Diameter of stem.			
	Inches.	*Inches.*	*Lbs. per sq. in.*	*Lbs. per sq. in.*	*Per cent.*
Breech-block, spindles, hinge-pins, and rollers	2.0	0.505	46,000	86,000	18.0
	3.0	0.564	46,000	86,000	16.0
Lever handles, breech plates, face plates, block-carriers, and nuts.	2.0	0.505	40,000	75,000	20.0
	3.0	0.564	40,000	75,000	18.0
Gas-check cups, gas-check rings and bars for securing pins.	2.0	0.505	70,000	125,000	12.0
	3.0	0.564	70,000	125,000	10.0

9. Additional tests.

If any piece separately tested fails to fill the physical requirements of these specifications, an additional set of specimens may be submitted for test. Failing to fill the physical requirements on this additional submission the piece shall be finally rejected except in special cases.

When tests are representative, re-testing shall be subject to the conditions, requirements, and limitations of paragraph 6 of these specifications for parts of breech mechanism.

10. Additional treatment.

When a piece fails to fill the physical requirements of these specifications, and re-annealing, or re-tempering and re-annealing is resorted to, complete tests shall be made, and the previous tests shall not be considered in deciding upon the acceptance or rejection of the piece. Representative re-treatment shall be conducted under the conditions, restrictions, and limitations prescribed for original representative treatment.

11. Parts required as rough forgings.

Those parts of breech mechanism required to be delivered simply as smooth forgings, or as simple castings, and without any requirement as to physical qualities, shall be made with great care, shall conform as nearly as practicable to the rough dimensions shown on the drawings, and shall be made of metal satisfactory to the inspector. Such parts shall be annealed after forging or casting, and shall receive no other treatment.

PART V.—GENERAL DUTIES OF INSPECTORS.

Officers and employés of the Ordnance Department assigned to the duty of inspecting material for ordnance constructions will carefully and constantly watch the details of manufacture in all its stages; keep complete records of the manufacture of each piece; decide all minor questions of detail referred to them by the manufacturers that may arise; and, subject to the confirmation of the Chief of Ordnance, accept all material which fairly fills the contract requirements. They will see that the work and treatment at every stage of progress fill the requirements of the specifications and are such that the test of the specimens to be taken will truly represent the piece, and will inform the manufacturers what additional work, treatment, etc., seem necessary to satisfy this condition.

Generally speaking they will not interfere with the means and methods adopted by the manufacturer for executing his work, but will rather pass upon their character as satisfactory or otherwise, and upon the uniformity of the execution.

In designating the position of and in marking test specimens they will be guided by the following instructions:

Test specimens taken from metal to be used in ordnance construction (excepting those taken from billets for wire drawing) will be marked on both ends to show:

1. The caliber of the cannon for which the metal is intended: 32 for 3.2 inches; 8 for 8 inches; 10 for 10 inches; 12 for 12 inches, etc.

2. The kind of cannon for which the metal is intended: R for steel rifle; MR for mortar; WR for wire-wound rifle; CIR for cast-iron rifle, etc.

3. The number of the cannon of the particular caliber and kind: 1, 2, 3, etc.

4. The part of the cannon for which the metal is intended: T for tube; J for jacket, etc. In the case of cast-iron cannon, or cast-iron bodies for cannon combined of steel and cast-iron, where the specimens are ordinarily taken from the initial tension rings, the abbreviation will be TR, showing that the specimen is from the initial tension ring; and if more than one initial tension ring is taken from either end, the abbreviations TR_1, TR_2, etc., will be used.

5. The end of the piece from which the specimen is taken: B for breech; M for muzzle.

6. The direction in which the specimen is taken: T for tangential, or those taken parallel to a tangent at the circumference; L for longitudinal, or those taken parallel to the axis of the cannon; R for those taken radially.

7. The number of the specimen: 1, 2, 3, etc. The same series of numbers to be used for each end (breech or muzzle) of the piece.

8. The position with reference to the interior and exterior surfaces of the piece of metal: I for inside specimens, or those taken near the interior surface; O for outside specimens, or those taken near the exterior surface; M for middle specimens, or those taken midway between the interior and exterior surfaces.

9. The fact that the specimen has been laid off and stamped in the presence of the inspector or his assistant, and that its identity is vouched for; this is indicated by the inspector's private stamp—the escutcheon of the Ordnance Department, one-quarter of an inch in diameter, on hardened steel.

These marks will appear in the order indicated; those required to indicate the points numbered 1, 2, 3, and 4 (which show from what the specimen is taken) being in one line, the remainder (which show how the specimen is taken) being in a second line just below the first as seen when looking at the end of the specimen. The marks and the inspector's private stamp should always be on the specimen from the time it is laid off until finished, and before they are effaced in one place by any finishing operation must be transferred to some other place in the presence of the inspector or his assistant.

The ring, slice, or piece which is to furnish test specimens, and the forging from which it is to be cut, will each be marked before the cut is taken, and close to the cut, to indicate the points numbered 1, 2, 3, 4, 5, and 9. These marks on forgings should always be on the piece, and before they are effaced in one place by any rough-finishing operation must be transferred to some other place in the presence of the inspector or his assistant.

S. V. BENÉT,
Brig. Gen., Chief of Ordnance, U. S. A

ORDNANCE DEPARTMENT,
Washington, D. C., September 10, 1888.

Appendix C.

TESTS TO BE APPLIED TO COMPLETED GUN PRESENTED FOR TEST.

BOARD OF ORDNANCE AND FORTIFICATION,
War Department, ——, 1889.

SIR: The act making appropriations for fortifications, etc., approved September 22, 1888, provides that—

> Whenever any party shall present for test a completed single-charge breech-loading steel gun of ten or twelve inches caliber, and of weight and dimensions to be prescribed by the Board with the proper supply of ammunition for the test of the same, such gun shall, in the presence of the party presenting it, be subjected to such tests as the Board shall have prescribed; and should such gun be shown to the satisfaction of the Board by such tests to fulfill the requirements previously prescribed in respect to accuracy, range, power, endurance, and general efficiency, the gun and ammunition shall be paid for at a fair valuation, including cost of transportation, and contract shall be made at a price reasonable in the opinion of the Board with the party presenting the best of such guns for a further supply of similar guns, to be subjected to the usual service test before acceptance, the experimental gun and all guns purchased hereunder to be subject to inspection at each stage of manufacture, as follows, namely: For not less than fifty ten-inch steel guns; and for not less than fifty twelve-inch steel guns.

To meet the requirements of this act the following conditions recommended by the Board of Ordnance and Fortification, have been approved by the Secretary of War, viz:

FOR A GUN OF 10 INCHES CALIBER.

The weight shall be about 30 tons (long).

The length of bore, 34 calibers, measured from the face of the obturator to the face of the muzzle of the gun. (In order that the gun may not require a special carriage for its proof it is desirable that the diameter of the trunnions be 12 inches, and the distance between rimbases 42 inches.)

The power shall be such as may be expressed by a muzzle energy of not less than 15,000 foot tons.

The range shall for 20 degrees of elevation be about 13,650 yards, corresponding ranges shall be obtained with lower elevations.

The standard of accuracy shall be as given in the following table, and shall be approximately obtained:

Table of accuracy—25 per cent. rectangles.

Range.	Vertical rectangle.		Horizontal rectangle.	
	Height.	Width.	Length.	Width.
Yards.	*Feet.*	*Feet.*	*Yards.*	*Yards.*
1,500	1.4	1.0	.....	.....
3,000	3.4	2.9	.....	.....
6,000	.....	.....	29.7	4.2
8,000	.....	.....	38.9	6.7
10,000	.....	.....	48.5	9.2

The endurance test should not be less than 300 rounds with full charges. After 250 or more rounds may have been fired, the gun may be lined wholly or in part, when at least 50 rounds more will be fired to fully test the strength of the construction. After this the general soundness and efficiency of the gun should not be materially impaired, except so far as may have resulted from erosion.

Should any material modification of the construction be made during the trial, at least 50 rounds, with full charges, shall be fired thereafter.

The weight of projectile to be used with the full charge shall be about 575 pounds.

Three hundred rounds of ammunition shall be the "proper" amount to be supplied with the gun for test.

As a proof of general efficiency the breech mechanism should work freely and be convenient for operating, the opening and closing of the breech to be performed without great difficulty by one man. The projectiles shall admit of being readily handled; inserted and centered in the bore, and not be subject to injury or deformation either in handling or transportation.

A rapidity of fire of 15 rounds per hour shall be attainable, using such appliances for loading as are employed by the Ordnance Department, U. S. Army.

The repairs allowable during the entire trial of a gun, exclusive of the insertion of a lining tube, will be confined to repairing or renewing parts injured during trial. No alterations that may affect the general construction of any part will be made without the sanction of the Board.

FOR A GUN OF 12 INCHES CALIBER.

The weight shall be about 52 tons. The length of bore shall be 34 calibers. (In order that the gun may not require a special carriage for its proof, it is desirable that the diameter of trunnions be 14.5 inches, and the distance between rimbases 49.8 inches.) The power shall be such as may be expressed by a muzzle energy of not less than 26,000 foot tons.

The range shall for 20 degrees elevation be about 14,700 yards, and corresponding ranges shall be obtained with lower elevations.

The accuracy shall be the same as that prescribed for a 10-inch gun.

The endurance shall not be less than 250 rounds, and a lining may be inserted after 200 rounds.

The weight of projectile for full charges shall be about 1,000 pounds.

Other conditions of test shall be the same as for a 10-inch gun, except

that under general efficiency a rapidity of fire of 10 rounds per hour shall be attainable.

It is not considered practicable for the Board to determine, at this time, what will be a "fair valuation" of an experimental gun which shall have fulfilled the requirements prescribed, nor what price would be "reasonable" for a further supply of similar guns. It is believed to be better on all accounts to leave these questions for determination after the actual cost and value of such guns can be known; it being understood as the duty of the Board to act in such matters with entire impartiality as between the United States and any party who shall attempt to supply the desired guns.

The act of Congress does not fix, and does not seem to authorize the Board to fix, any limit of time within which experimental guns shall be presented for test. It is therefore considered sufficient to say that it is regarded by the Board as desirable that the experimental guns be submitted as soon as practicable, and within three years from the present time.

Respectfully, your obedient servant,

_____ _____,

Captain Ordnance Department, U. S. Army,
Recorder of the Board.

Appendix D.

TEST OF CAST-IRON MORTAR.

[House Ex. Doc. No. 158, Fifty-first Congress, first session.]

REPORT RELATIVE TO THE ORDNANCE PROVING GROUND, SANDY HOOK, N. J.

LETTER FROM THE SECRETARY OF WAR, TRANSMITTING A REPORT OF THE TEST OF THE 12-INCH RIFLED MORTAR, PRESENTED BY THE SOUTH BOSTON IRON WORKS, AT THE ORDNANCE PROVING GROUND, SANDY HOOK, N. J.

WAR DEPARTMENT,
Washington, January 27, 1890.

The Secretary of War has the honor to transmit to the House of Representatives, for the information of the Committee on Appropriations, an extract of the proceedings of the Board of Ordnance and Fortification of December 12, 1889, together with the report of Lieut. Col. A. Mordecai, Ordnance Department, United States Army, of the test of the 12-inch cast-iron breech-loading rifled mortar, presented, under the provisions of the first paragraph of section 6 of the act approved September 22, 1888, by the South Boston Iron Works, at the Ordnance Proving Ground, Sandy Hook, N. J.

REDFIELD PROCTOR,
Secretary of War.

The SPEAKER OF THE HOUSE OF REPRESENTATIVES.

EXTRACT OF PROCEEDINGS OF THE BOARD OF ORDNANCE AND FORTIFICATION.

WAR DEPARTMENT,
Washington, D. C., December 12, 1889.

* * * * * * *

The Board then considered the report of the tests of the 12-inch breech-loading cast-iron rifled mortar of the South Boston Iron Works, submitted by the Chief of Ordnance under date of November 1, 1889, and referred to the Board November 4, 1889, by the Secretary of War.

The 12-inch breech-loading cast-iron mortar presented for trial by the South Boston Iron Works under paragraph 1, section 6, of the act of Congress approved September 12, 1888, was tested in the presence of the Board of Ordnance and Fortification on October 3, 4, and 5, 1889. On the twentieth round the mortar burst, terminating the trials. The report of the Chief of Ordnance giving all needful details is herewith transmitted. The programme contemplated a repetition round for round of the firing made with the 12-inch cast-iron steel-hooped breech-loading mortar now at Sandy Hook, and this programme was carried out. As it appears from the table of the detailed report an examination of the fragments disclosed no cavities or imperfections in the metal. The shot fired at the last round was recovered and was found upon a measurement to be correct in caliber.

* * * * * * * *

J. M. SCHOFIELD,
Major General, U. S. Army, President of the Board.

C. C. MORRISON,
Captain, Ordnance Department, Recorder.

Report of test of 12-inch breech-loading rifle mortar, cast-iron, presented by the South Boston Iron Works, at the Ordnance Proving Ground, Sandy Hook, N. J. Conducted by the commanding officer of the Proving Ground for the Board of Ordnance and Fortification.

The test of this mortar was conducted in accordance with the programme of the Board of Ordnance and Fortification contained in its proceedings of June 13, 1889, furnished to the commanding officer of the Ordnance Proving Ground by the Chief of Ordnance United States Army with his letter of June 26, 1889.

The necessary preparations having been completed and final instructions received from the Chief of Ordnance, due notice was given to the Board of Ordnance and Fortification, through its recorder, and to the South Boston Iron Works.

The firing was commenced on October 3, 1889, and continued on October 4 and 5.

The programme required that the first twenty rounds should be as follows, viz:

Order of firing.	Powder.		Weight of projectile (shell).	Pressure.	Velocity.	Order of firing.	Powder.		Weight of projectile (shell).	Pressure.	Velocity.
	Kind.	Weight					Kind.	Weight			
		Lbs.	*Lbs.*	*Lbs.*	*Feet.*			*Lbs.*	*Lbs.*	*Lbs.*	*Feet.*
1	O. X. A.	50	624½	.....	.....	11	O. X. A.	65	627½	26,700	1,033
2	do	55	626½	21,000	959	12	E. V. F.	50	630½	25,450	960
3	do	55	624½	21,000	959	13	do	50	622½	25,450	960
4	do	60	616½	23,100	1,014	14	do	53	624½	27,550	1,006
5	do	65	627½	26,700	1,033	15	P. G.	50	623½	22,600	948
6	do	65	616½	26,700	1,033	16	do	55	623½	26,500	1,002
7	do	65	627½	26,700	1,033	17	do	55	623½	26,500	1,002
8	do	65	630½	26,700	1,033	18	do	58	623½	28,300	1,034
9	do	65	628½	26,700	1,033	19	O. V.	55	623½	28,800	1,012
10	do	65	628½	26,700	1,033	20	do	55	623½	28,800	1,012

The Chief of Ordnance, under date of September 27, 1889, furnished the commanding officer of the proving ground for his guidance, a copy of a report of the Board of Ordnance and Fortification, approved by the Secretary of War, to the effect that:

* * * * * * *

(2) It is recommended that if the charges of powder laid down in the Board's programme of June 13, 1889, do not give the pressures and velocities specified, the Chief of Ordnance be authorized to make such changes in the weights of charge as may be necessary to attain the results prescribed.

(3) It is recommended that the Chief of Ordnance be authorized to ballast, as was done with the light shell for the 12-inch hooped mortar, such projectiles presented by the South Boston Iron Works as may be below weight, in order that the weight shall be the same as that used in the corresponding round from the hooped mortar.

* * * * * * *

) It is recommended that the offer of the Chief of Ordnance, contained in the a paragraph of the first indorsement, be accepted and that he be requested to

furnish the Board with such ammunition, other than that supplied by the party presenting the mortar for test, as may be necessary to carry out the programme of test prescribed from time to time by the Board; this ammunition to be paid for by exchange, as suggested by the Chief of Ordnance, or by an allotment of funds to be made hereafter by the Board.

As the object of the Board in its programme of June 13, 1889, is to subject the mortar presented by the South Boston Iron Works to substantially the same strains as those which have been sustained by the hooped mortar, it is the desire of the Board that if any lot of a type or any type of powder laid down by the Board in its programme be not on hand, the Chief of Ordnance shall cause to be used any lot of the same type or some other type of powder known to give about the same results.

The South Boston Iron Works had delivered at the proving ground for use in their mortar two hundred shell, banded, and 3,000 pounds Brown Prismatic Powder of R. H. type. The powder had not been proved, was not required during the test, and therefore none of it was used.

Of the shell, twenty were fired; some were used at their natural weight, whilst others were ballasted with sand to the weight required; they all were of the same construction as those used by the United States Ordnance Department in its 12-inch hooped mortar, though the bands were not so accurately formed.

In accordance with the foregoing instructions, O. X. C. powder was substituted for O. X. A. in the first eleven rounds, and E. V. K. for E. V. F. in the next three rounds, there being neither O. X. A. nor E. V. F. on hand. In the remaining six rounds, the exact powder prescribed in the programme was used.

In the ninth, tenth, eleventh, thirteenth, fourteenth, and eighteenth rounds, in order to regulate the pressures, the charges of powder were changed from those laid down in the programme for the corresponding rounds.

The following table shows the charges, pressures, and velocities prescribed, and the charges used, and the pressures and velocities obtained at each round:

Number of round.	Powder.				Weight of projectile (shell).		Pressure.		Velocity 125 feet from muzzle.	
	Kind.		Weight.							
	Prescribed.	Used.	Prescribed.	Used.	Prescribed.	Used.	Prescribed.	Obtained.	Prescribed.	Obtained.
			Pounds	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Feet.*	*Feet.*
1	O. X. A.	O. X. C.	50	50	624½	624	Not given.	19, 540	No: given.	889
2	...do	...do	55	55	626½	626	21, 000	21, 010	959	938
3	...do	...do	55	55	624½	624	21, 000	20, 630	959	937
4	...do	...do	60	60	616½	616	23, 100	22, 900	1, 014	986
5	...do	...do	65	65	627½	627	26, 700	25, 005	1, 033	1, 020
6	...do	...do	65	65	616½	617	26, 700	24, 118	1, 033	1, 015
7	...do	...do	65	65	627½	627½	26, 700	24, 570	1, 033	Not taken.
8	...do	...do	65	65	630½	630	26, 700	25, 653	1, 033	Not taken.
9	...do	...do	65	67	628½	628	26, 700	26, 708	1, 033	Not taken.
10	...do	...do	65	67	628½	628	26, 700	26, 070	1, 033	1, 029
11	...do	...do	65	69	627½	628	26, 700	27, 450	1, 033	1, 052
12	E. V. F.	E. V. K.	50	50	630½	631	25, 450	27, 900	960	972
13	...do	...do	50	47	622½	623	25, 450	25, 590	960	937
14	...do	...do	53	50	624½	624	27, 550	27, 250	1, 006	965
15	P G	P. G	50	50	623½	624	22, 600	24, 438	948	954
16	...do	...do	55	55	623½	624	26, 500	26, 953	1, 002	1, 001
17	...do	...do	55	55	623½	624½	26, 500	27, 030	1, 002	1, 003
18	...do ...	...do	58	57	623½	624	28, 300	28, 450	1, 034	1, 031
19	O. V	O. V	55	55	623½	624	28, 800	28, 090	1, 012	1, 011
20	...do	...do	55	55	623½	624	28, 800	29, 055	1, 012	Lost.

The pressures and velocities noted as obtained are the mean of two instruments.

From the above, it appears that though the pressure at some rounds was above that prescribed, the total strain to which the mortar was subjected was below what was intended.

At the twentieth fire, the mortar burst violently into many pieces, which were scattered far and wide, demolishing the top carriage, the intermediate carriage, and the traverses of sand bags that had been placed upon three sides of the carriage. The projectile struck the ground 60 feet from the muzzle of the mortar, broke both the velocity frames standing at respectively 75 feet and 175 feet from the muzzle, and passed into the sand butt, from which it was subsequently recovered.

The muzzle of the mortar was broken into three pieces, all of which went to the front, one to a point only a few feet in rear of where the projectile first struck the ground.

The shell was found to be cut quite deeply in several places on the cylindrical and on the conoidal portions as though scraped by the lands on pieces of the broken mortar. One of the muzzle fragments is thought to indicate quite plainly the work it did upon the projectile.

During all the firings there were present Mr. W. P. Hunt, jr., representing the South Boston Iron Works, and one or more members of the Board of Ordnance and Fortification.

There are forwarded herewith:

(1) The firing record.
(2) Drawing No. 1, showing the lines of fracture of the mortar.
(3) Drawing No. 2, showing size and location of fragments of mortar after rupture.
(4) Photograph No. 1, front view of mortar before bursting.
(5) Photograph No. 2, front view, after bursting of mortar, showing right traverse, etc.
(6) Photograph No. 3, front view after bursting of mortar, showing left traverse, etc.
(7) Photograph No. 4, view from rear, after bursting of mortar, showing shield for protection of velocity wires, struck by projectile at its first graze, etc.
(8) Photograph No. 5, view of rear traverse, and breech-block where it landed.
(9) Photographs Nos. 6, 7, and 8, views of projectiles, all sides shown.

A. MORDECAI,
Lieutenant Colonel Ordnance Dept., U. S. Army, Commanding.

NEW YORK ARSENAL, *October* 28, 1889.

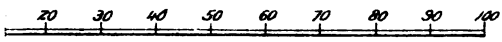
PLATE I.

FRACTURE ON

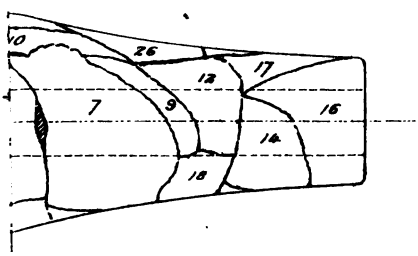
ST IRON MORTAR

UTH BOSTON IRON WORKS

ARD OF ORDNANCE AND FORTIFICATION U.S.A.



SCALE OF INCHES



GHT SIDE

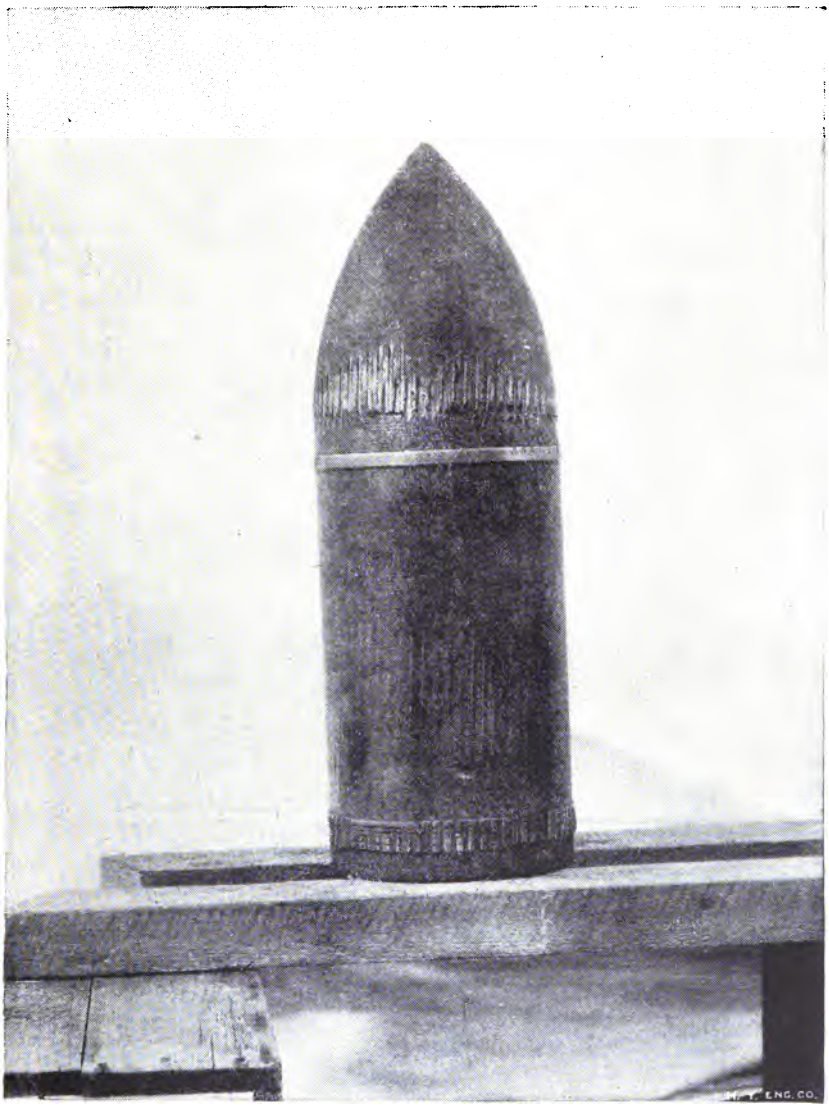
U. S. ORDNANCE PROVING GROUND

SANDY HOOK, NEW JERSEY OCTOBER 28TH 1889.

No. 1. Front View of Mortar before bursting.

No. 2. Front View, after bursting of Mortar, showing right Traverse, etc.

No. 3. Front View after bursting of Mortar, showing left Traverse, etc.



No. 6. The right Element of the Projectile in Photograph is the one that was at the highest Point when the Shell was loaded in the Mortar.

Record of firing with 12-*inch B. L. rifled mortar (cast-iron), South Boston Iron-Works, at Sandy Hook, N. J., October* 3, 1889.

[Object of firing: to test mortar.]

No. of fire.	Powder.		Weight of projectile (mortar shell; lot 241).	Travel of shot in bore.	Elevation.	Instrumental velocity — feet from muzzle.	Pressure, pounds per square inch of bore.	Recoil.	Counter recoil.		Special remarks about each fire, such as effect on piece, action of breech mechanism, consumption of powder, sound of projectile in flight, scattering of fragments, etc., and metrological data.
	Kind.	Weight.									
		Pounds.	*Pounds.*	*Feet.*	° ′	*Feet.*		*Feet.*	*Feet.*		
						889	A				
1	(*)	50	624	91.9	0 30	889	18,840	50½	45½	Gun mounted on 15-inch barbette carriage, F. P. Timby's. Bolster and forks removed and chassis placed upon wooden frame; three-eighths inch was filed off the vent shield to allow primer and wrench to enter. Pressure plugs in the obturator head, A above, B below, in a vertical line. The cylinder was just filled with oil and then 4 gallons were taken out. After round 1, 2 gallons of oil were added to the cylinder. After round 4, 2 gallons of oil were added to the cylinder. Fired into sand butt, section 4. Obturating electric primers. During the firing the gun and carriage moved back about 2 feet, owing to the rear support giving way.	Breech-block closed and opened easily; obturation good.
						888	B				
							20,240				
						939	A				
2	(*)	55	626	92.1	0 25	938	21,620	51	46		Do.
						937	B				
							20,400				
						939	A				
3	(*)	55	624	91.6	0 20	937	21,140	51	47		Do.
						935	B				
							20,120				
						986	A				
4	(*)	60	616	91.7	0 15	986	23,180	51½	48½		Do.
						985	B				
							22,740				
						1,021	A				
5	(*)	65	627	91.7	0 15	1,020	26,075	51¾	48¾		Breech-block did not close or open quite so easily as in previous rounds. Console opened slightly; obturation good.
						1,019	B				
							23,935				
						1,015	A				
6	(*)	65	617	91.6	0 15	1,015	24,925	49	45		Breech-block closed and opened easily; obturation good.
						1,014	B				
							23,300				
							A				
7	(*)	65	627½	91.6	0 15	Not taken	26,060				Do.
							B				
							22,080				

* Du Pont's Sphero-Hexagonal, O. X. C. Density, 1.795; granulation, 100.

Present, Col. H. L. Abbot, Col. H. W. Closson, and Lieut. Col. A. Mordecai, on part of the Board of Ordnance and Fortification, and Mr. W. P. Hunt, jr., and Mr. H. Sinclair representing the South Boston Iron-Works. Col. H. L. Abbot and Col. H. W. Closson not present at round 7.

Record of firing with 12-*inch B. L. rifled mortar* (*cast-iron*), *South Boston Iron-Works, at Sandy Hook, N. J., October* 4, 1889.

[Object of firing: to test mortar.]

No. of fire.	Powder. Kind.	Powder. Weight.	Weight of projectile (mortar shell; lot 241).	Travel of shot in bore.	Elevation.	Instrumental velocity—feet from muzzle.	Pressure, pounds per square inch of bore.	Recoil.	Counter recoil.		Special remarks about each fire, such as effect on piece, action of breech mechanism, consumption of powder, sound of projectile in flight, scattering of fragments, etc., and metrological data.
		Pounds.	*Pounds.*	*Feet.*	° ′	*Feet.*		*Feet.*	*Feet.*		
8	(*)	65	630	91.6	0 15	Not taken.	A 25,750 B 25,565	48	41	Nut on spindle of mushroom head tightened before firing. Supports in rear of carriage were renewed before firing round 8. Pressure plugs in the obturator head in a vertical line, A above, B below. Fired into sand butt, section 4. Obturating electric primers.	Breech-block closed and opened easily; obturation good.
9	(*)	67	628	91.75	0 15	Not taken.	A 27,690 B 25,725	48	42		Console spring catch did not hold, causing interruption in closing breech-block. Obturation good. Action of catch, same as in round 9. Obturation good.
10	(*)	67	628	91.6	0 15	1,029 1,029 Lost.	A 26,440 B 25,700	49	43		Do. Breech-block closed and opened easily. Obturation good. Do.
11	(*)	69	628	91.7	0 15	1,052 1,052 Lost.	A 27,950 B 26,950	50	44		
12	(†)	50	631	91.7	0 10	971 972 972	A 28,400 B 27,400	51	44		
13	(†)	47	623	91.5	0 5	936 937 937	A 25,860 B 25,320	44½	38		

* Du Pont's Hexagonal E. V. K. Density, 1.750; granulation, 72. †Du Pont's Sphero-Hexagonal O. X. C. Density, 1.795; granulation, 100.

Present, Col. H. L. Abbot, Col. H. W. Closson, and Lieut. Col. A. Mordecai, on part of the Board of Ordnance and Fortification, and Mr. W. P. Hunt, jr., and Mr. H. Sinclair, representing the South Boston Iron-Works.

Record of firing with 12-inch B. L. rifled mortar (cast-iron), South Boston Iron-Works, at Sandy Hook, N. J., October 5, 1889.

[Object of firing: to test mortar.]

No. of fire.	Powder. Kind.	Powder. Weight.	Weight of projectile (mortar shell; lot 241.)	Travel of shot in bore.	Elevation.	Instrumental velocity—feet from muzzle.	Pressure, pounds per square inch of bore.	Recoil.	Counter recoil.		Special remarks about each fire, such as effect on piece, action of breech mechanism, consumption of powder, sound of projectile in flight, scattering of fragments, etc., and metrological data.
		Pounds.	*Pounds.*	*Feet.*	° ′	*Feet.*		*Feet.*	*Feet.*		
						965	A				
14	(*)	50	624	91.6	0 5	965	27,550	45½	38		Breech-block closed and opened easily. Obturation good.
						965	B	.....	.....		
							26,950	.....	.....		
						953	A	.....	.....		
15	(†)	50	624	91.5	0 5	954	24,750	45½	38		Do.
						954	B	.....	.....		
							24,125	.....	.....		
						1,002	A	.....	.....		
16	(†)	55	624	91.65	0 5	1,001	27,785	47	39		Do.
						1,000	B	.....	.....		
							26,120	.....	.....		
						1,004	A	.....	.....	Pressure plugs in obturator head in a vertical line, B above, A below. Fired into sand butt; section 4. Obturating electric primers.	
17	(†)	55	624	91.6	0 10	1,003	27,600	48	40		Breech-block closed and opened easily. Obturation good. Console opened one-half inch during firing.
						1,002	B	.....	.....		
							26,500	.....	.....		
						1,031	A	.....	.....		
18	(†)	57	624	91.6	0 00	1,031	28,760	49½	40½		
						1,030	B	.....	.....		Breech-block closed and opened easily. Obturation good. Console opened three-quarter inch during firing.
							28,140	.....	.....		
						1,008	A	.....	.....		
19	(‡)	55	624	91.4	0 5	1,011	28,600	49	41		
						1,013	B	.....	.....		Do.
							27,580	.....	.....		
							A	.....	.....		
20	(‡)	55	624	91.5	0 10	Lost.	29,930	.....	.....		
							B	.....	.....		
							28,180	.....	.....		Gun burst, demolishing carriage.

* Du Pont's Hexagonal E. V. K. Density, 1.750. † Du Pont's Sphero-Hexagonal P. G. Density, 1.775. ‡ Du Pont's Sphero-Hexagonal O. V. Density, 1.750.

Present, Col. H. L. Abbot and Lieut. Col. A. Mordecai, on part of the Board of Ordnance and Fortification, and Mr. W. P. Hunt, jr., representing the South Boston Iron Works.

Cannon—where made, South Boston Iron-Works; weight of piece, 14 tons; total length, 129 inches; length of bore, 107.625 inches; kind of carriage, 15-inch timbers, upper carriage blocked against rubber buffers. Second carriage controlled by hydraulic recoil cylinder. Carriage mounted on timbers supported against posts sunk in sand; kind of pressure gauge, crusher; location of pressure gauge, in face of obturation head; kind of ballistic instrument, Le Boulangé chronographs, Nos. 112 and 314; kind of breech-closure, De Bange slatted screw; diameter of powder-chamber, 12.4 inches; nominal length of powder-chamber, 18.82 inches; pitch of rifling, 1 turn in 35 calibers; number of grooves, 68; width of grooves, 0.379; depth of grooves 0.07 inches; width of lands, 0.17496 inches.

NEW YORK ARSENAL, *October* 28, 1889.

A. MORDECAI,
Lieut. Col., Ordnance Department, Commanding.

Appendix E

EXPERIMENTS WITH HIGH EXPLOSIVES.

WASHINGTON, D. C., June 1, 1889.

Colonel ——: The committee appointed at the last meeting of the Board has the honor to submit the following report:

Experiments with a view to the use of bursting charges of shell may be regarded by the Board from two points of view: 1st, as a matter of investigation to determine the experimental data now desired, as to the physical properties and best modes of bursting types; and, 2d, as a matter of testing to determine the merit of the several designs submitted by inventors. It is desirable that these investigations and tests should be carried forward together and at once.

High explosives will be used in two different kinds of shells, viz: armor piercing and common. The difficulties to be overcome with the former are vastly greater than with the latter. Moreover the necessity for piercing armor is less than formerly, because the area heavily plated on war ships is becoming less and less. Thus only about half of the water line is protected by armor in recent British types, and in French ships even the guns themselves are often fired from exposed barbettes. The chief dependence against sinking is in the under-water armored deck, usually about 3 inches thick, and the water-tight compartments. The experiments now in progress with the *Resistance* in England demonstrate that the effects of common shell even of small calibers, charged with high explosives, are disastrous when occurring within the unarmored part of the hull. Finally, the expense of iron plates for targets for the armor piercing class is so great that it appears to be wise for us to begin with common shell, and leave armor-piercing trials for a later date.

For successful use of high explosives in common shells three elements must be considered: (1) the envelope, (2) the explosive, (3) the igniting mechanism.

Cast iron as a material for the envelope is too uncertain to command confidence when the result of a slight defect may be the destruction of the gun by premature explosion. Even in experimenting, experience has shown that no doubt as to the character of the projectile should be tolerated. It is therefore advised that those to be ordered be made of good open hearth steel.

As to patterns, it is desirable that such be chosen as can be fitted to receive different internal arrangements for loading. Those of the Ordnance Department marked "Ordnance Board, U. S. Army, Governors [illegible] December 24th, 1888," and "January 7th, 1889," are well suited [illegible] rejected trials, and are recommended for adoption. They have

the Eureka sabot for use in muzzle-loading guns; and the following are the more important dimensions.

	7-inch.	11-inch.	15-inch.
Estimated weight in pounds	120	430	1,325
Length of body in calibers	2.75	2.5	3.5
Radius of ogival in calibers	1.5	1.5	1.5
Total length in inches	20.5	29	54.5
Thickness of wall in inches	1.3	2.25	2
Capacity in cubic inches	160	496	3,348
Capacity in pounds of water	5.8	18	124

As to the explosive, we have now before the Board explosive gelatine, gun cotton, Emmensite, the Schwalm mixture, dynamite, and Americanite, or the Smolianinoff compound.

Experiments of the kind to be undertaken involve no little time, labor, and expense, and they should therefore be restricted to what promise ultimate success. This is not the case with the Americanite, because the liquid form and the liability to become dangerous through evaporation or by lying in store would forbid its use in the military service, unless trials should demonstrate that no other variety free from these objections can be so used. That this explosive is liable to deterioration has been proved to the satisfaction of your committee by the results of a personal examination of a sample left in store at Sandy Hook after the trials made by the Ordnance Board in November, 1887. This sample is contained in a glass bottle, stored in a magazine of the fort. On April 5, 1888, a surface stratum of different appearance from that below was noted by Col. Mordecai. It was then half an inch thick. On July 10 it was fifteen thirty-seconds of an inch thick. On January 3, 1889, it was fully half an inch thick. On March 26, 1889, the date of our inspection, it was seven thirty-seconds of an inch thick, the whole height being 6 inches. Samples of the two strata were then carefully taken with a pipette and at once tested with a hammer on an iron slab. The upper gave no decrepitation, but the lower acted in all respects like pure nitroglycerine, except that it was perhaps a trifle less sensitive. Stirring the mixture with a glass rod produced no apparent change or recombination of the fluid; but at a subsequent examination, on June 1, a great change had occurred. The appearance then was for 2 inches at the bottom a white fluid; above that for about 1 inch a cloudy combination of white and yellow fluid; the remaining fluid to surface was of uniform yellow color. An explosive possessed of such characteristics would be extremely dangerous in a loading room, and your committee therefore recommends that the action already taken by the Board on March 14th, 1889, in advising that experiments with this explosive be deferred for the present be adhered to. As to dynamite, it is well known to be far more sensitive to shocks than others on the list, and as none of the inventors seem to prefer it to explosive gelatine for testing their loading devices, it is recommended that it be left untried for the present. This reduces the list to explosive gelatine, gun cotton, Emmensite, and the Schwalm mixture.

As to the igniting mechanism, the following conditions should be fulfilled by a pattern suitable for use in coast defense. The class of fuse should be percussion, with base action and a slight delay action, and with a sensitiveness adjusted for a projectile striking the unarmored side of a war ship. To insure an explosion of the first order in the charge of the shell, a detonating primer of great intensity is essential. An initial explosion of mercuric fulminate, say 10 grains, in a large

priming charge of dry gun cotton or other high explosive will probably be required to insure an explosion of the first order in a nonsensitive explosive suited for use in shells (one pound is used with wet gun cotton), and provision must be made accordingly. It is recommended that the Ordnance Department be requested to give this matter special attention, as the original devices we have received from inventors appear crude and unpractical. If possible, samples of the base fuse of Wolff & Co., should be obtained at Walsrode, Germany, as it is claimed to fulfill all conditions and to act perfectly.

From this résumé it appears that the following points are to be investigated:

(1) *Which is the best explosive for use in shells?*—To decide this point we must consider: (*a*) safety in handling and storage, regard being had to ordinary shocks and friction in handling, to deterioration in store, and to extremes of heat and cold; (*b*) Intensity of action when exploded; and (*c*) Density of loading. Should the trials prove that several varieties of high explosives can be safely fired in projectiles, the ultimate choice between them will depend on these considerations; and they should also largely influence the order in which trials are made. Much information as to (*a*) is already in our possession, and the means of extending it need not be further considered here. The trials at Willets Point probably afford as accurate an idea of intensity of action (*b*) as can be had. They indicate that, assuming dynamite No. 1 as 100, explosive gelatine is 142, dynamite No. 2 is 83, and gun cotton is 87. The corresponding value of Emmensite will soon be determined from trials now in progress. As to density of loading, (*c*), the specific gravity of explosive gelatine is about 1.54, that of compressed gun cotton being about 1.2, and that of Emmensite No. 1 in the fused form about 1.7. Dynamite No. 1 varies from unity in powder to about 1.6 in compressed cartridges. From these figures, and the special devices to prevent premature explosions, the density of loading may be computed.

(2) *Is an explosion of the first order, or detonation, assured with the different modes of loading proposed by the inventors to prevent premature explosion?*—To test this matter it is proposed to explode duplicate sets of cast-iron shells like those shown on page 229, Report of the Chief of Ordnance for 1884 (caliber, 8-inch; cavity, 5 inches in diameter and 10 inches deep; capacity, about 192 cubic inches, or 6.9 pounds of water). One set will be charged precisely as proposed by the inventor; the other will contain the same amount of the explosive in a compact mass with the rest of the cavity sand-filled. The projectiles will be placed at the bottom of holes about 8 inches in diameter and 4 or 5 feet deep, bored in uniform clay soil and tamped with sand. From the measured crater radii after the explosion it is believed that a fair idea can be formed as to whether the loading devices reduce the order of the explosion. The following trials of this nature are recommended, all to be duplicated, and if necessary more than duplicated, to assure accuracy; about forty shells should be provided:

Four shells to test the Stevens's method of loading with explosive gelatine.

Four shells to test the Graydon-Pratt method of loading with pellets of explosive gelatine.

Four shells to test the Graydon-Pratt method of loading with tubes of explosive gelatine pellets.

Four shells to test the relative power of Emmensite in a fused and in a coarsely granulated condition.

Four shells to test the German mode of packing Wolff gun cotton with paraffine and Carnauba wax (half and half).

(3) *Will the explosive stand the friction due to rifled motion when loaded as proposed?*—To obtain more definite information as to the heating effect of this motion than is now available, it is proposed to communicate a high rotary velocity to projectiles by mechanical means, and thus to investigate the subject practically. The details of apparatus for this purpose have not yet been sufficiently studied for definite recommendation at this time. A velocity of about 1,400 feet, with rifling of one turn in 35 feet, will call for a rotary velocity of 2,400 turns per minute.

(4) *Will the explosive stand the shock of firing when loaded as proposed by the different inventors?*—To test this matter it is proposed to purchase one hundred 7-inch and fifty 11-inch projectiles, of the patterns described above, and to fire them from the Ames gun and from the 11-inch converted muzzle-loading rifle at Sandy Hook. The cost of these projectiles is roughly estimated at about $10,000. The methods of loading to be tested are the Stevens, the Graydon pellet, and the Graydon tube, all with explosive gelatine; also, if thought best, the Schwalm explosive. Also the behavior of Emmensite and Wolff gun cotton fired with no special mechanical provisions in the shell—the former being packed by fusion and the latter by the German mode of melted paraffine. All these experiments should be made by firing at long ranges over water, so that a practical test of the effect of rifled motion as well as the shock of firing may be had.

(5) *Will the igniting mechanism stand the shock of firing and the rifled motion without premature action?*—This matter should be tested quite independently of the explosive, which may be accomplished by using shells charged with powder in a field or siege gun, or perhaps by charging several primers in one shell, thus reducing expense.

(6) *Will the igniting mechanism act as desired?*—This may be tested by firing shells charged with powder.

(7) *Will the shell, without the igniting mechanism, explode on impact (a) with water, (b) with earth, (c) with stone, (d) with wood or light iron, and (e) with iron armor?*—Information on some of these points will be obtained incidentally, and the others may be left for future consideration.

This series of trials will determine whether it will be needful to resort to the complicated and costly double projectiles proposed by some inventors—information which should be secured before incurring the expense of fabricating them. They cover all that appears to be demanded at present, except to test Dr. Cook's device, which, being rather an incendiary shell than one to carry a powerful charge of high explosives, may properly be left for future consideration.

It is recommended that this series of trials be carried out at Sandy Hook, except the trials with shells buried in the earth, which should be made at Fort Wadsworth or Fort Hamilton, where it may be found most convenient to obtain suitable soil. The work should be done under the direction of the Ordnance Department, the Board or some of its members visiting the ground from time to time to thoroughly understand the progress made and to witness the more important experiments.

Respectfully submitted.

HENRY L. ABBOT,
Colonel of Engineers, Brevet Brigadier-General.
A. MORDECAI,
Lieutenant-Colonel, Ordnance Department.

Maj. Gen. JOHN M. SCHOFIELD,
President Board of Ordnance and Fortification.

EXPERIMENTS WITH HIGH EXPLOSIVES.

NEW YORK CITY, *October 12, 1891.*

GENERAL: In compliance with the resolution of the Board at its last session, the committee on high explosives has the honor to submit the following report upon the work accomplished during the seasons of 1890 and 1891, with recommendations for the further prosecution of the trials.

The trials were conducted under the direction of the Chief of Ordnance, and usually in the presence of both members of the committee. The reports herewith of Col. Mordecai, Capt. Shaler, and Capt. Heath supply all needful details, and the following table presents a consolidated abstract so arranged as to render discussion easy. The first trial was made on August 20, 1890, and the last on September 12, 1891.

The general scope of the investigation undertaken by the Board is sufficiently set forth in the preliminary report of this committee, dated June 3, 1890. Unexpected delays in obtaining materials for the projected trials have occurred, and thus far experiments have been restricted to heads (1), (2), and (4), and indeed chiefly to head (2) of that report. Their character is thus stated:

> To test whether an explosion of the first order, or detonation, is assured with the different modes of loading proposed by the inventors, it is proposed to explode duplicate sets of cast iron shells like those shown on page 229, Report of the Chief of Ordnance for 1884 (caliber, 8 inch; cavity, 5 inches in diameter and 10 inches deep; capacity, about 192 cubic inches, or 6.9 pounds of water). One set to be charged precisely as proposed by the inventor; the other to contain the same amount of the explosive in a compact mass with the rest of the cavity sand-filled. The projectiles will be placed at the bottom of holes about 8 inches in diameter and 4 or 5 feet deep, bored in uniform clay and tamped with sand. From the measured crater radii after the explosion it is believed that a fair idea can be formed as to whether the loading devices reduce the order of the explosion.

The trials were made near the old redoubt at Fort Hamilton. The measurements of crater radii were made with accuracy, the border being defined by the broken edges of the turf which covered the site selected. This measurement was assisted by the use of a frame of radial arms, made of wood and placed by range flags exactly over the hole occupied by the shell. Eight radii were thus measured and recorded, the mean appearing in the table below and the single measurements in the detailed reports. As the cavity of the shell was in all cases filled, as nearly as practicable, the number of pounds of the explosive used affords an approximate clue to the density of loading allowed by the different modes proposed by the inventors.

The formula used in the analysis is the usual expression for land mines, the coefficient, $\frac{1}{17}$, being derived from certain recorded English experiments with high explosives fired in subterra shells, together with the preliminary trial marked No. 1 in the table. This formula is the following, in which C denotes the charge of explosive gelatine in pounds; L, the length of the line of least resistance in feet; and R, the crater radius in feet. The sign of (R-L) in the second member must be carefully noted.

$$C = \frac{1}{17}\left(L + \frac{7}{8}(R - L)\right)^3$$

The accuracy of this formula is attested by the fifth, sixth, seventh, eighth, and ninth trials, none of which were used in deriving the coefficient. The percentage of error shown by these trials is respectively, −1, +2, +0.5, −2, and +4.4 per cent. These are the only

direct comparisons made, but they are deemed sufficient to establish the general accuracy for charges of 10 pounds or less.

Another matter in this connection demands attention. The energy developed by an explosion is expended (1) upon the iron shell, and (2) in the formation of a crater. The latter only can be measured. In the intercomparison of different charges and different explosives it therefore becomes important to determine the relative, and as nearly as may be, the absolute values of (1) and (2), expressed in pounds, of explosive gelatine required to do the work.

With this object in view four trials (Nos. 30, 31, 32, and 33) were made to compare the crater-forming power of 10 pounds of explosive gelatine contained in light tin cans (offering no sensible resistance) with that exhibited when contained in the cast-iron shells adopted for these trials. The figures in the table below show that trial No. 31 differed widely from the other three, suggesting some error in estimating the exact boundary of the crater in that case. Applying Pierce's criterion for the rejection of doubtful observations, this record is thrown out, leaving as the means of the other three 10.39 pounds, with a probable error of 0.14 pounds. Hence the crater-forming charge, 10 pounds, fired in a tin can is the equivalent of 10.4 pounds fired in the standard cast-iron shell. In other words, rather less than 4 per cent of the energy developed by the explosion of 10 pounds of explosive gelatine is absorbed in the destruction of the shell envelope, thus escaping measurement in the crater formed by the explosion. As this measured part is so small absolutely, and as it affects probably to a nearly equal amount all the comparative measurements and the computations based thereon, it may safely be neglected in the discussion of the following table:

No. of trial.	Explosive (with per cent of camphor).	Mode of packing.	Charge.	Line of least resistance.	Observed crater radius.	Explosive gelatine by formula.	Average.
			Pounds.	*Feet.*	*Feet.*	*Pounds.*	
1	Explosive gelatine, 2 per cent	None	10.0	7.0	4.90	8.08	
2	do	Stevens' damp	10.0	4.8	5.13	7.76	
3	Explosive gelatine, 4 per cent	do	10.0	4.8	5.14	7.81	7.81
4	do	do	10.0	4.8	5.15	7.85	
5	do	None	10.0	4.8	5.62	9.89	
6	Explosive gelatine, 2 per cent	do	10.0	4.85	5.68	10.22	10.06
7	Explosive gelatine, 4 per cent	do	10.0	4.8	5.66	10.06	
8	do	do	7.69	4.825	5.07	7.53	
9	do	do	7.69	4.8	5.20	8.03	7.78
10	do	Graydon	7.70	4.8	None.	Burned.	
11	do	do	7.70	4.8	do	do	
27	do	Graydon modified	6.78	4.86	do	do	
12	Emmensite	None	9.81	4.75	4.63	5.90	
13	do	do	9.81	4.7	4.75	6.27	5.49
14	do	do	9.81	4.8	4.09	4.30	
15	Walsrode wet gun cotton	do	6.1	4.7	2.90	2.62	
16	do	do	6.23	3.875	3.97	3.65	
19	do	do	6.23	3.825	3.93	3.54	3.19
20	do	do	6.23	3.875	3.67	2.97	
17	do	C. wax and Paraffine	6.20	3.8	3.10	1.91	
18	do	do	6.26	3.8	3.83	3.28	
21	do	do	6.23	3.875	3.97	3.65	3.14
22	do	do	6.23	3.9	4.00	3.74	
23	Rackarock	None	12.06	4.875	5.69	10.29	
24	do	do	12.0	4.875	5.50	9.38	
25	do	do	12.03	4.85	5.32	8.56	9.41
26	do	do	12.0	4.8	5.52	9.42	
28	Explosive gelatine, 4 per cent	In tin can	10.0	4.8	None.	Burned.	
29	do	do	10.0	4.8	do	do	
30	do	do	10.0	4.65	5.81	10.63	
31	do	do	10.0	4.71	6.69	*15.71	
32	do	do	10.0	4.76	5.80	10.73	10.39
33	do	do	10.0	5.18	5.54	9.82	
34	do	Longitud. diaph	10.0	4.75	5.95	11.48	
35	do	do	10.0	4.75	5.58	9.26	9.70
36	do	do	10.0	4.90	5.26	8.37	

* Reject.

No. of fuze.	Explosive gelatine 4 per cent.	Mode of packing.	Charge.	Line of least resistance.	Observed crater radius.	Explosive gelatine by formula.	Average.
			Pounds.	*Feet.*	*Feet.*	*Pounds.*	
7	Explosive gelatine 4 per cent.	Transverse disks	10	4.65	5.38	8.81	9.73
8	do	do	10	4.41	5.44	9.36	
10	do	do	10	4.30	5.72	10.44	
60	do	Long and trans. disks	10	4.56	5.11	8.56	9.96
4	do	do	10	4.57	5.91	11.43	
62	do	do	10	4.57	5.96	11.71	
63	do	do	10	4.31	5.30	8.08	8.87
64	do	Wet sand dry	10	4.57	5.15	8.27	
65	do	do	10	4.46	5.29	8.86	
66	do	do	10	4.55	5.72	9.47	
67	German sand mass	Nine	8	4.55	1.95	(*)	2.04
68	do	do	8	2.9	2.59	2.04	
69	Powder states as to powder	do	7.5	4.2	2.89	1.51	1.93
70	do	do	7.7	2.9	3.42	2.35	
71	Permite B	do	12.76	5.27	6.46	13.04	17.59
72	do	do	12.46	5.0	6.75	17.14	
73	Permite C	do	12.47	4.9	6.29	15.42	15.47
74	do	do	11.87	5.25	6.51	15.53	
75	Permite D	do	9.19	4.55	5.69	10.28	

* Camouflet.

Proceeding now to the analysis of the results of the trials, each special object will be considered in turn.

THE STEVENS PACKING.

Not made public, at request of Mr. Stevens.

* * * * * * *

In view of the foregoing, and of the trials already made at the United States proving ground with Mr. Stevens's shell fired from guns, the committee does not recommend any further experiments with his method of packing, until it has been tested on the rotating machine.

THE GRAYDON PACKING.

The whole interior of the shell was lined with a layer of asbestos paper, 0.25 of an inch thick. The explosive charge was separated between three compartments, one hemispherical and two cylindrical in form, by two brass disks placed at right angles to the axis of the shell. These disks were 0.09 of an inch thick, and were pierced by many holes. They were supported by a central brass tube, which was half an inch in diameter, 8.25 inches long, and 0.063 of an inch thick. It was pierced with fifty-six small holes opening into the two cylindrical compartments. This tube contained at trial No. 10 a priming charge of about 225 grains of rifle powder, ignited by an electric primer charged with 4 grains of mercuric fulminate, placed at one end. In trial No. 11 the priming charge was about 197 grains of rifle powder, ignited by an electric primer placed at one end and charged with 24 grains of mercuric fulminate. The total weight of asbestos was about 1.5 pounds, and of the brass parts 1.1 pounds. The explosive charge (explosive gelatine) was made in pellets about an inch long and half an inch square, wrapped in light manilla paper, with the ends folded and the whole coated with paraffine. The entire cavity of the shell was filled. The loading was done by Capt. Judson, representing the company.

As shown by the foregoing table, both of these charges failed to detonate, but burned with a strong flame, giving off nitrous fumes and white and later bluish smoke that cleared the hole of the sand tamping,

but created no crater. The cast-iron shell was fractured, and a small cavity from 26 to 29 inches in diameter was formed in the earth about it.

At the twenty-seventh trial this packing was modified as follows, by Capt. Judson: The asbestos lining was retained, but the tube and disks were replaced by a double tube of tin. The inner of these tubes contained the priming charge of rifle powder, ignited by a 24-grain mercuric fulminate primer; the outer tube was designed to delay the explosion when fired from a gun by allowing the inner tube, held in position by a spring, to move forward and explode a cap at impact with the target. This mechanism represented the kind of fuse proposed by the company for use in shell firing. The result of the experiment was the same as before. The charge burned but did not detonate.

These trials have satisfied your committee that this mode of packing shells with high explosives can not be trusted to secure an explosion of the first order unless the explosive be of a dangerously sensitive character, and therefore that no trial of the device should be made from guns.

TRIALS WITH EMMENSITE.

No packing was used, none being deemed necessary by the inventor when this explosive is fired from guns. Dr. Emmens was represented by his son and his agent, Mr. Strong. These gentlemen loaded the shells, ramming the Emmensite to a solid mass with the handle of a pickax, without care to avoid shocks.

The grade of Emmensite used in these experiments is that known as No. 259. It has a pale yellow color and a strong smell of nitrobenzol. It was stated to contain picric acid, dinitro-benzene, ammonium nitrate, and sodium nitrate. It was packed in paraffined paper and inclosed in tin cans, but exhibited a tendency to cake. This grade is designed specially for military use, being unnecessarily expensive for ordinary blasting.

The subterra trials with Emmensite were chiefly designed to afford data for judging of the relative energy developed by this and other high explosives. The following results were obtained: A charge of 9.81 pounds of the grade tested proved, in three trials, to be equally effective in moving the earth above the charge as 5.9 pounds, 6.27 pounds, and 4.30 pounds of explosive gelatine, respectively. These figures indicate considerable variations in the strength of the different charges, but if we may adopt the mean, or 5.49 pounds, as the true equivalent, the desired ratio is $\frac{5.49}{9.81}$, or 0.56 of the power of explosive gelatine (0.80 of that of dynamite No. 1).

These figures indicate that this explosive ranks with gun cotton in explosive energy, while the rough handling to which it may be safely subjected, and the favorable results already obtained in small guns by Maj. McKee, led the committee to place it at the head of the list for trial in shells fired from cannon. The first three shells received from the manufacturers were therefore devoted to this purpose, and on July 22, 1891, they were successfully fired at Sandy Hook. The gun was a 7-inch Ames muzzle-loading rifle. The propelling charges were 23, 23, and 25 pounds of Dupont's hexagonal E. V. K. powder. The shells contained 8.4 pounds, 7.6 pounds, and 7.4 pounds of Emmensite No. 259, respectively, their total weight being about 135.5 pounds. The elevation was uniformly 11°. The pressure in the bore, determined subsequently by duplicate shots, was about 30,000 pounds per square inch, and the initial velocity about 1,420 feet per second. The shells contained

fuses and they all fell in the water at long ranges without exploding, thus resisting successfully both the initial shot in the bore and all the effects of rotation due to the rifling. Emmensite is evidently worthy of further trials so soon as suitable larger shells for the purpose are available.

TRIALS WITH WET GUN COTTON.

The object of these trials was to determine how much, if any, loss in explosive energy is caused by the method of packing the charge with paraffine and Carnauba wax, in the manner adopted by Germany and Italy.

Four shells were fired loaded with 6 pounds of Walsrode wet gun cotton, ignited by a 24-grain mercuric-fulminate primer bedded in from 0.10 to 0.23 pounds of dry gun cotton. Detonation occurred in each case, showing that the charge exerted equal earth-lifting force with 3.19 pounds of explosive gelatine. Four other shells were then fired loaded with 6 pounds of wet gun cotton packed with 1.5 pounds of paraffine and 1.5 pounds of Carnauba wax, melted together and filling the interstices of the charge; detonation was obtained by a 24-grain mercuric-fulminate primer bedded in 0.23 pounds of dry gun cotton and placed at the end of the charge. The mean earth-lifting force developed was equivalent to that of 3.15 pounds of explosive gelatine, showing by comparison with the above that no sensible loss of energy resulted from the mode of packing. A direct comparison of the mean crater radii—3.62 feet and 3.74 feet, respectively—suggests the same conclusion, which may thus be regarded as established.

These eight trials also denote that wet gun cotton (15 per cent of water) has $\frac{3.17}{6.21}=0.51$ of the explosive energy of explosive gelatine; or 0.73 of that of dynamite No. 1. Gen. Abbot's ratio for charges of dry gun cotton fired under water at Willets Point is 0.87, which corrected for 15 per cent of water in the charge becomes 0.74, to compare with the above.

Experiments were made to determine the amount of the loss of water from evaporation to which Walsrode wet gun cotton is subject when removed from the sealed metallic packing cases and exposed to dry air. A charge of 49.755 grams said to contain 15 per cent of water was thus exposed with the following result: Total loss in one day, 4.075 grams; in three days 6.945 grams; in four days, 7.345 grams; in six days, 7.485 grams; in ten days, 7.545 grams. As the reported amount of water was only 7.46 grams originally, and as this sample had been removed from a sealed can and kept in a damp place for eight days before this measurement was made, these figures demonstrate that Walsrode wet gun cotton must be kept sealed, or loaded in air-tight shells, to retain the moisture.

As the trials above reported indicate that this mode of packing with paraffine and Carnauba wax does not cause a loss of explosive energy when shells are loaded with wet gun cotton, and as the explosive has been used by Germany and by Italy as suitable for this purpose, an early trial in shells fired from guns is recommended.

TRIALS WITH RACKAROCK.

Messrs. Gillespie and Brouchaud propose to use this explosive in shells fired from powder guns, the dinitro-benzol being contained in a glass receptacle bedded in the potassium chlorate and broken by the shock

of discharge. They trust for the proper mixing of the ingredients (1) to the great pressure developed by a movable part of the shell when the charge of gunpowder in the gun is ignited, and (2) to the centrifugal force due to the rapid revolution of the projectile during its flight. Obviously, no test of this mode of mixing is possible with stationary shells. A few trials, however, were made to compare the explosive energy of rackarock with that of other high explosives when fired in buried shells. As no special mode of packing is proposed by those inventors, none was used in these trials, which were made in their presence, the shells being loaded by them. It was stated that about 5 per cent of red mineral paint had been added to the potassium chlorate, in order to promote rapid absorption. The proportion of the ingredients adopted was ten parts of the solid, by weight, to two and one-half of the liquid, and the mixing is done in a manner to secure uniformity. In loading, the bags were removed and the charge was rammed solidly in the shell without any lining. A coat of common glue is used by the company to protect the primers against the liquid. The detonators used in these trials consisted of 24-grain mercuric fulminate primers, bedded sometimes in one and sometimes in three 1¼-ounce disks of dry gun cotton protected against the liquid by a wrapping of paraffined paper. These were sometimes placed centrally and sometimes at one end of the charge. Full detonation was apparently caused in each case.

Considerable variation in energy is shown by the table, but if the mean may be accepted as normal the strength of the explosive as compared with that of explosive gelatine is given by the ratio $\frac{9.41}{12.02}$ or 0.78. As compared with dynamite No. 1 this ratio becomes 1.11. The rackarock used at the explosion at Flood Rock, tested under water at Willets Point by Gen. Abbot, gave 1.08 for the latter ratio. Rackarock is, therefore, to be regarded as a very powerful explosive, and as the proposed mode of mixing solid and liquid ingredients during the flight of the projectile is novel, it appears worthy of test in shells fired from powder guns; but as there will always be a possibility of accidental leakage in shells so charged, the effect of the concussion and rotation upon the explosive itself must ultimately be determined. Danger from friction is specially to be apprehended from explosives of the potassium chlorate class, and it is therefore recommended that trials with rackarock be next continued on the rotating machine, now in preparation, as soon as it is received.

INVESTIGATIONS WITH EXPLOSIVE GELATINE.

Explosive gelatine possesses so great merits in respect to intensity of action, density of loading, and a sensitiveness admitting of regulation by the addition of suitable percentages of camphor, that, although trials at Sandy Hook in former years proved unsatisfactory, the Board approved the recommendation of the committee that the investigation be continued. For this purpose, and more generally for use with other explosives if necessary, a study has been made experimentally with a view to prevent rotation or compression of the mass by subdividing the charge; and this in such a manner as not to interfere with full detonation under the action of the fuse. Shells subdivided by logitudinal diaphragms, by transverse diaphragms, and by a combination of longitudinal and transverse diaphragms have been tested successfully. The fundamental idea was to imbed the detonating fuse in a sufficient mass of the explosive to insure the detonation of the entire charge, although

[redacted]

[redacted] trials [redacted] inclusive. [redacted] are thrown out [redacted] per cent for [redacted] per cent for [redacted]. These are quite within [redacted] and warrant the conclusion [redacted] the detonation in no serious degree lessened the explosive energy [redacted] The committee, therefore, recommend an early trial from [redacted] of explosive gelatine in shell embodying the principles of [redacted]

GERMAN SMOKELESS AND RIFLE POWDERS.

[redacted] were fired to compare the effects of black powder with that of high explosives, and to determine whether confinement and a detonating fuse (5 grains mercuric fulminate) would induce detonation in the sample of German smokeless powder imported for trial in the 6-inch breech loading rifled gun at Sandy Hook. The results appear in the above table (No. 17 to No. 50, inclusive). They suggest the following conclusions:

Nothing in the nature of detonation occurred with the German smokeless powder. Bursting grains were thrown high in the air, and many partially burned grains were recovered in and around the crater. No estimate of the weight of the explosive actually consumed was possible; hence no precise comparison with the other explosives can be had, but it will be noted that the work, as measured by the two

craters, is less than, but not very unlike, that performed by the two corresponding charges of United States rifle powder having the same volume.

There is no reason to suppose that the black powder (United States rifle) failed to fully burn; and its strength as compared with explosive gelatine for work of this nature (crater-forming) would, therefore, be indicated approximately by the ratio $\frac{1.93}{7.5} = 0.26$ if it could be assumed that the energy expended upon the shell itself is the same with both explosives. But this assumption is inadmissible since the iron fragments are much less disrupted by the charge of black powder. The limit of this ratio, however, may be computed from the experiments already discussed, showing that about 0.4 of a pound of explosive gelatine is expended in disrupting the shell itself. If no work whatever were thus expended by the powder, the ratio would become $\frac{1.93-0.4}{7.5}=0.20$.

In other words, these experiments indicate that, for forming shell-craters in earth, explosive gelatine, pound for pound, is more than four times and less than five times as effective as United States rifle powder. Its greater density of loading, as 10 to 7.5, still further adds to this marked superiority for such work.

TRIALS WITH PERUNITE (TERRORITE).

The samples tested were prepared by the inventor, Prof. Mendeleff, who with his assistant, Mr. Gerdes, was present at the trials, to represent the California Explosive Company. The desirable features of two patents (perunite and terrorite) were combined in the explosives as presented, which Prof. Mendeleff stated represented the best for the military service which could be submitted by the company. The samples were four in number, marked A, B, C, and D.

Sample A was prepared in California. To 80 volumes of nitroglycerine, purified as described in his patent (sp. gr. 1.6), is added 10 volumes of nitroethyl (sp. gr. 0.60) and 10 volumes of nitromethyl (sp. gr. 0.789). The compound (sp. gr. 1.4) is a clear, colorless liquid and must be kept tightly corked.

Sample B was prepared at Fort Hamilton by adding 8 per cent of specially prepared pyroxiline to sample A and allowing it to dissolve at the temperature of the air. This action could have been expedited by the use of an air pump. A trace (2 grains to the half gallon) of red aniline dye was added to aid in detecting leakages and spillings. The explosive thus prepared was a fluid not of homogeneous density; in pouring from a bottle it ran sometimes like thick oil; at other times it appeared to clog; again it flowed freely almost like water, although this occurred rarely. It was stated that sample B can be exploded with an ordinary powder cartridge, and that it was believed to be stronger than either C or D.

Sample C was also prepared at Fort Hamilton by adding 12 per cent of specially prepared pyroxiline, 2 per cent of camphor, and a trace of aniline dye to sample A, and allowing the materials to thicken at the temperature of the air. The use of an air pump would have reduced the time required. This sample was more pasty than B, but it showed traces of pyroxiline not fully dissolved, and when removed from the cool magazine it became decidedly more fluid. It was loaded in the shells by pouring, moving like thick honey with wax floating therein.

RECOMMENDATIONS.

The committee recommends: (1) That experiments be made at once with shells fired from powder guns be continued as much as possible as early a day as practicable; (2) that the bore of the 8-inch rifle-cannon with wet gun cotton packed with [illegible] be prosecuted without loss of time; (3) that the [illegible] be made with explosive gelatine in shells [illegible] on the principles embodied in pattern (*e*) already tested [illegible] early experiments on the rotating machine be made

with rackarock having the ingredients mixed; and that if the results are favorable the trials be continued in shells fired from powder guns.

Sufficient progress has been made in these subterra trials to warrant a classification of the explosives, already tested, according to their relative merit in shells designed to form craters in earthen parapets—upon the assumption (by no means established) that modes can be devised for firing them safely without reducing their natural density of loading. This relative merit is shown by the product of their relative earth-lifting power, as above determined, by their weights when charged in the standard shell cavity (192 cubic inches). These figures of course are chiefly of practical value as indicating in what direction experiments should be pushed. They are the following:

Perunite B	1.44×12.2=17.57
Perunite C	1.28×12.2=15.61
Perunite D	1.12×12.2=13.66
Explosive gelatine	1.00×10.0=10.00
Rackarock	0.78×12.0= 9.36
Emmensite	0.56× 9.8= 5.49
Gun cotton	0.51× 6.2= 3.16
United States rifle powder	0.23× 7.5= 1.72

The following programme is suggested for the continuation of the trials in the early future:

With subterra shells.—Such tests as may be needed from time to time to determine the merits of any new explosive or new modes of charging which may be approved for trial by the board.

With the rotating machine.—A sufficient number of trials to determine whether the danger of premature explosion is to be apprehended from the rotation caused by the rifling when shells thus charged are fired from powder guns: (1) With explosive gelatine in shells having longitudinal and transverse diaphragms combined; (2) in shells without diaphragms containing wet gun cotton packed with paraffine and Carnauba wax; (3) in similar shells containing Emmensite; (4) in similar shells containing rackarock mixed; and (5) in similar shells containing explosive gelatine packed according to the Stevens method.

With the 7-inch muzzle-loading rifle.—(*a*) Ten shells, with diaphragms as above, loaded with explosive gelatine containing 4 per cent of camphor. Firing to be over water, with propelling charges of about 25 pounds of Dupont's hexagonal E. V. K. powder, or its equivalent, with an elevation of about 11°, and without a fuse. (*b*) Five shells, without diaphragms, charged with wet gun cotton packed with paraffine and Carnauba wax, under similar conditions. (*c*) If previously successful on the rotating machine, five charges of rackarock with ingredients mixed.

With the 11-inch muzzle-loading rifle.—Ten shells to be fired loaded with Emmensite, ten more loaded with wet gun cotton, and ten with explosive gelatine, when these explosives have passed a successful test in the 7-inch rifle. The charge in all cases to be regulated to give as severe a shock and as high an initial velocity as the gun will bear; no fuses to be used; the range to be over water, and the firing to be done at rather high angles of elevation.

Fuses with shells charged with high explosives.—It is regarded by the committee as extremely important to prosecute the trials recommended in the first report so soon as samples can be procured.

Remarks.—In order to carry out this programme special shell must be provided for use in the rotating machine. It is thought that when diaphragms are to be used the shell should have octagonal cavities, and that the others should be cylindrical in form. In all of them the rough-

ness of the interior surface should correspond to that of the ordinary service shell. In order to determine the advantageous thickness of diaphragm, several different thicknesses should be tried with charges of dry sand. Two shells for diaphragms and three without them will probably be sufficient.

As Emmensite has already been tried in the 7-inch and smaller guns, its test in the 11-inch gun can be proceeded with at once. The other trials in the 11-inch gun should follow corresponding trials in the 7-inch gun and on the rotating machine.

In the conduct of these experiments discretion must be used in making a greater or less number of trials, without too rigid an adherence to the programme as laid down.

Respectfully submitted.

HENRY L. ABBOT,
Colonel of Engineers,
Brevet Brigadier General, U. S. Army.
A. MORDECAI,
Colonel, Ordnance Department, U. S. Army.

Maj. Gen. JOHN M. SCHOFIELD,
President Board of Ordnance and Fortification.

Appendix F.

SITES FOR PROVING GROUNDS.

[House Ex. Doc. No. 148, Fifty-first Congress, first session.]

TESTING AND PROVING HEAVY ORDNANCE.

LETTER FROM THE SECRETARY OF WAR, TRANSMITTING A REPORT OF THE BOARD OF ORDNANCE AND FORTIFICATION RELATIVE TO A SITE FOR TESTING AND PROVING HEAVY ORDNANCE.

WAR DEPARTMENT,
Washington City, January 22, 1890.

The SPEAKER OF THE HOUSE OF REPRESENTATIVES:

The Secretary of War has the honor to transmit to Congress the report of the Board of Ordnance and Fortification, dated January 18, 1890, and accompanying papers, made in compliance with so much of the act making appropriations for the support of the Army for the fiscal year ending June 30, 1890 (25 Stat., 833) as requires an examination and report "upon a site or sites for ordnance testing and proving ground to be used in the testing and proving of heavy ordnance, having in view in the selection of said site or sites their accessibility by land and water, means of transportation, and suitability for the purpose intended, and also the actual and reasonable cost, and the value of the land embraced in said site or sites, and the least sum for which the same can be procured."

REDFIELD PROCTOR,
Secretary of War.

BOARD OF ORDNANCE AND FORTIFICATION,
WAR DEPARTMENT,
Washington, D. C., January 18, 1890.

SIR: As directed by the act of Congress making appropriations for the support of the Army for the fiscal year ending June 30, 1890, and for other purposes, the Board of Ordnance and Fortification has made an examination of "a site or sites for ordnance testing and proving ground to be used in the testing and proving of heavy ordnance, having in view in the selection of said site or sites their accessibility by land and water, means of transportation, and suitability for the purpose

intended, and also the actual and reasonable cost, and the value of the land embraced in said site or sites, and the least sum for which the same can be procured;" and has now the honor to submit the following report thereon.

The work to be done at an ordnance testing and proving ground is of two distinct classes, which if necessary may be performed at two different sites. Thus every gun, before issue for service, must be fired a few times to verify the perfection of the breech mechanism and the proper adjustment of the several parts of which it is composed. This is simply to prove the guns when fired with service charges, and can be done at any site that fulfills the following conditions:

(*a*) It should be in the near vicinity of the gun factory, with ready means of intercommunication. This would reduce the loss of time and cost of transfers to a minimum, and would enable slight corrections to be made in the same shops and by the same workmen who have fabricated the guns.

(*b*) The area must be large enough, when provided with suitable butts, to guard against accidents which may be caused in the neighborhood by projectiles escaping from control.

(*c*) Sufficient space should intervene between the firing point and private establishments, to prevent the noise from being an annoyance to the population. As the distance between the guns and the butts will always be limited to a few hundred yards, an extensive tract is not necessary for this purpose; an area of about 4 square miles, in approximately a circular shape, will, if situated in a sparsely-populated district, fulfill the requirements.

The other class of work for which an ordnance proving ground is necessary is of entirely a different character. It comprises a thorough and exhaustive test of new types of guns, new carriages on which to mount them, new explosives, new fuzes and igniting mechanism, armor plates of new types and samples delivered for test by manufacturers, new devices for protecting guns against hostile fire, in a word, the researches demanded by modern progress in developing the countless varieties of new war material.

Doubtless, if it were practicable to combine these two classes of work at a single site, the best solution of the problem of where to select an ordnance proving ground would be reached, but a personal examination of the vicinity of the new gun factory at Watervliet Arsenal has convinced the Board that this can not be done. Two sites are demanded for efficient service.

The following conditions should be fulfilled by a site suited to the general investigations indicated above.

(1) *As to dimensions.*—Unless the tract be separated by water from land in the vicinity, considerable width is needful to avoid danger to surrounding property. Projectiles are liable to erratic flights, especially after the first graze, and the fragments caused by bursting charges of high explosives in shells scatter over a wide area. Two miles is by no means an excessive estimate for the width required. As to length, certain facts are to be considered. By far the greater part of the firing will be at comparatively short ranges; for such ranges are best adapted to the determination of initial velocity and accuracy of flight and to testing armor plates and new types of fortification. It is true that projectiles now have a flight of 10 miles and upward, but these extreme ranges can be computed by modern improved methods with sufficient accuracy to meet most practical demands. To throw light upon the important matter of the length needful for a modern proving

ground, the Board has made an analysis of all published firing at the Krupp range at Meppen, from the beginning of the trials there in 1877 to October, 1889. These publications show that 5,944 shots, or 68 per cent., were fired at ranges less than 3,000 meters; 1,526 shots, or 17 per cent, at ranges between 3,000 and 6,000 meters; 1,097 shots, or 13 per cent., at ranges between 6,000 and 9,000 meters; and 196 shots, or 2 per cent., at ranges exceeding 9,000 meters (5.5 miles). Also that of the shots fired at ranges exceeding 3,000 meters, by far the greater number were fired in the years 1880, 1881 and 1882, when the accuracy of trajectory formulæ at long ranges was under experimental study. Thus of the 1,526 shots fired at ranges between 3,000 and 6,000 meters, 962, or 63 per cent., were fired in these years; of the 1,097 shots fired at ranges between 6,000 and 9,000 meters, 898, or 81 per cent., were fired in the same three years; and of the 196 shots fired at ranges exceeding 9,000 meters, 115, or 59 per cent., were also then fired. These figures indicate that if facilities for occasionally firing at extreme ranges over water exist, a land range ten miles in length can not be regarded as imperatively demanded—indeed that a much less length may suffice.

This conclusion is also reached by considering in some detail the classes of fire, three in number, demanded by a modern proving and experimental ground, viz:

(*a*) Firing required in testing the endurance of a gun, including the working of its parts in continued practice; the initial velocity of projectiles, or in general any question wherein the nature of their flight has not to be considered. This would be "butt firing," and would be confined within 300 yards.

(*b*) Such firing as is required in determining the measure of accuracy of a cannon; comprising both the comparative accuracy at different stages of the test and the relative accuracy of different systems; examinations of the fire of canister and shrapnel, and the general flight of projectiles, etc. For these purposes the limit of range can be taken at 4,500 yards.

(*c*) The fire used in determining the capability of a gun as to range, or the range corresponding to a given charge and elevation, as in verifying range tables, etc. The limit of distance desirable can here be placed at 15,000 yards, or about 8½ miles.

The great ranges over land heretofore desirable in solving ballistic problems may be considered as no longer essential; at least they have become of secondary importance. This class of fire can be over water, as by employing a long base line the errors arising from the use of plane tables will not be great.

In vertical firing, as with mortars, it is advantageous to have a land range of some 6,000 yards, but this need not be over level or uninterrupted ground. The limit of land range for this class of fire may therefore be taken at about 3½ miles.

(2) *As to the topographical features.*—A generally level tract is needed, free from bogs, forests, and undergrowth, especially of a character which would entail the delays and cost of frequent removal. The soil must be suitable for the erection of repair-shops, magazines, laboratories, platforms for heavy guns, proving butts, targets, including armored structures, bomb-proofs, railways, roads, and quarters for the men employed. Sand for the butts should be abundant. The tract must not be traversed by railroads or important routes of communication. Finally, a large sheet of water, over which firing can be had, is indispensable for testing shells charged with high explosives, shrapnel, seacoast fuzes, and other new material. Recent developments have made

this condition more imperative than heretofore, and any site not possessing such a sheet of water should now be rejected as fatally defective.

(3) *As to surroundings.*—The proving ground should be situated at an absolutely safe distance from towns, villages, pleasure resorts, and agricultural districts, present or prospective, but it should also be easily accessible both by rail and by water from general workshops and depots of supply. The water route and a good local harbor where large vessels may lie in safety are specially important, since guns and other heavy material must be received and shipped at any time without danger or delay. The site should also be in good protective relations with the general system of coast and frontier defense; otherwise it would be liable to destruction at the outbreak of war, when its use might be of the utmost importance to the country.

(4) *As to climate.*—The site should be healthy, and not subject to extremes of heat or cold, in order that the work may be uninterrupted. Strong winds and fogs which would interfere with firing should not prevail.

(5) *As to cost.*—The location should be chosen where the price of land will not be exorbitant if purchase be necessary.

These conditions, which accord in most particulars with the views of the previous Boards that have considered the subject, have been used as a criterion by which to judge the several sites examined.

SITES FOR PROOF BUTTS.

The Board took into consideration the selection of a suitable site for proof butts for use in connection with the gun-factory at Watervliet Arsenal. Locations were examined as follows:

(1) All land not now occupied by buildings within the limits of the arsenal, especially that portion west of the shops now in process of construction, and upon which there is at present located a small butt for proving field guns. The Board is satisfied that the proof of heavy guns could not be safely or advantageously made within the limits of the arsenal.

(2) South and west of the arsenal grounds. This tract adjacent to the arsenal was found inadequate in extent for the purpose required.

(3) The range of hills immediately west of the arsenal. Two ravines were examined, together with the hills bounding them. Proximity to Albany and West Troy and the cost of land as nearly as could be ascertained were such as to render it inadvisable to purchase in this vicinity, although the ravines with the hills on either side made a good natural location.

(4) West of Albany, south of the New York Central Railroad, from 6 to 12 miles from the capitol building in Albany, lies a tract of sand hills of little value for agricultural or other purposes. It contains but few houses and is but little cultivated. It is gently rolling country, traversed east and west by three roads and north and south by a few roads—all of little importance. The tract is not so distant from Watervliet Arsenal as to render its use impracticable without a séparate establishment. The Board deems it necessary, for the sake of isolation and safety, that the proof ground should be 2 miles square, and has selected such a tract and favors its purchase. With a view of ascertaining the probable value, options were obtained over as much of this selection as possible. It is believed that it will be necessary to resort to condemnation to secure this purchase, as the number of owners is so great that oppositions to sell could not be obtained from all.

SITES FOR AN ORDNANCE TESTING AND PROVING GROUND.

The Board has made an extended examination of sites on the Atlantic sea-board (see accompanying map) with a view to collecting as full information as possible respecting localities which might be available for the testing and proving of heavy cannon. The results are set forth in the following descriptions, arranged in geographical order from north to south:

(I) *Cape Cod from Plymouth by Provincetown to Nauset Harbor.*—The whole of Cape Cod was examined, although no section of it had been offered for sale.

The natural supply point would be Boston, distant from Plymouth 37 miles and from Provincetown 120 miles.

Transportation by rail from Watervliet Arsenal would be to Boston by the Troy and Boston Railroad and thence by the Old Colony Railroad. The distance to Plymouth is about 240 miles, and to Provincetown 320 miles. Water transportation to either of these extreme points would be possible, but intermediate points on either side of Cape Cod have no suitable harbor.

From Plymouth to Cedarville, about 8 miles south of Manomet Point, the land is so rough and broken as to be entirely unsuited to the purpose even if cleared of timber. From Cedarville to Sandy Neck Light is a narrow beach. The town of Sandwich extends nearly to the water's edge, as do other small towns along the line of the railroad.

From Barnstable to Eastham are stretches of beach, but the towns extend very close to the shore, as indeed is the case everywhere throughout this district. From Eastham to Wellfleet the ocean front is broken by inlets. On the eastern shore of Cape Cod from Cahoon Hollow life-saving station to Nauset Harbor the beach is straight for a distance of 10 miles. Between these limits from Negro Hollow opposite South Village to Nauset Beacons, a distance of 4 miles, extends a level plateau from 1 to 2 miles wide and about 125 feet above the water. It is entirely unoccupied by houses or roads and is unbroken from one end to the other. Water-range facilities would be very good and within the limits above stated, which include the whole grounds suitable for proving ordnance; the land range is perfect. On the other hand, guns could not be landed anywhere in the near vicinity, and the climate is so severe as to seriously interrupt work except during the summer months. Land is here worth about $5 an acre.

From Nauset Beach beacons to Chatham the tract is too narrow to be of any value for testing ordnance.

(II) *Southern coast of Rhode Island, from Watch Hill to Point Judith.*—Point Judith, at the eastern extremity of a straight reach extending to Watch Hill, is situated about 6 miles south of Narragansett Pier, and can be reached only by wagon from Narragansett. If a harbor were made of Point Judith Sound by dredging, guns could be landed within 1½ miles of the natural location of the battery on Point Judith.

Transportation from Watervliet would be by rail to Narragansett Pier, a distance of about 230 miles, or by water to the same point about 325 miles.

The site would be the section between the mail road, which runs about a mile north of the shore line at Quonocontaug Pond, and about 2 miles north of it at Rocky Point, and thence to Point Judith Neck on a southeasterly line. The country rises very gradually from the shore to the mail road, and the coast line is visible throughout its whole extent

from Point Judith. There are several ponds or lakes occupying large portions of the area. For the first 5 miles west from Point Judith the ground lies well for either vertical or horizontal fire; and by going north of Charlestown Pond it would be practicable to obtain targets for vertical fire for 3 miles more without encroaching on the road. Along the coast line for 10 miles is a good location for horizontal fire, except that, the shore being slightly concave, there would be some danger from ricochet. The portion of the ground on Point Judith is somewhat higher than the remainder of the coast line, and is therefore well adapted for batteries and buildings.

The position would require its own defenses, lying as it does without those of Narragansett Bay.

The facilities for land range are quite good and for water range perfect. There are but few houses west of Point Judith in the section named, but the building of cottages from Narragansett Pier is extending toward Point Judith. No roads at present would be interfered with. The climate is well adapted to the purpose, though at times in winter work might be interrupted by high winds.

The average cost of land would be from $400 to $500 an acre, owing to the proximity to Narragansett Pier; and the residents of this watering place would probably object to the location of a proving ground here, and the land will eventually be desired for building purposes.

The district from Quonocontaug Pond westward to Watch Hill is so broken by ponds, and the level strip along the coast is so narrow, as to render it unsuitable for a proving ground; nor is there sufficient of the coast line continuously visible to give the range required. The average cost of land here would be about $150 an acre.

(III) *Fisher's Island.*—This island is situated at the eastern end of Long Island Sound, nearly opposite New London, which is the nearest supply station, and is distant about 9 miles. It is reached by steamer from New London or Stonington. Transportation from Watervliet would be by the Hudson River and Long Island Sound—distance about 285 miles. Railroad transit, if desired, would be to New London and thence by water.

The island has an extreme length of about 6 miles. It varies in width from about a mile near the western end to a narrow neck near the eastern end. A little over a mile from the west end West Harbor cuts the island nearly in two. Opposite the end of the harbor is Prospect Hill, from which point nearly the whole island is visible. The surface is very much broken, although there are several level tracts, and many parts are covered with bowlders of considerable size. Two miles from Prospect Hill are lakes extending nearly from shore to shore.

The battery would naturally be located on Prospect Hill, or some hill still farther to the east, thus reducing the range to 5 miles or less, but the surface is too rough and rocky for good land ranges. Facilities for a water range are excellent.

As to defensive relations, batteries may probably be located on the island in connection with the general protection of the eastern entrance to Long Island Sound.

There are at present several hotels and numerous cottages situated here. To procure complete isolation the whole island would have to be purchased, although a portion of it would meet the needs of the Gov-
nt for a proving ground. The probable cost can not be definitely
island, except about 200 acres, was, it is understood, pur-
over a year ago for about $125,000, and is still owned

by the same party. The hotels and most of the cottages are located on the excepted 200 acres.

(IV) *Montauk Point.*—This site is situated at the eastern end of Long Island, extending from Napeague Beach to Montauk Point. It is about 100 miles from New York City, and 22 miles from New London, Conn.

The water routes of supply are by way of New London or Sag Harbor. A small steamer runs during the summer from New London to Fort Pond Bay. The nearest point to rail communication is Bridge Hampton, 21 miles distant.

The transportation from Watervliet Arsenal would be by water by the Hudson River and Long Island Sound to Fort Pond Bay, distance about 280 miles; communication with forts on the sea-board would naturally be by water.

The proposed site commences at the eastern end of Napeague Beach, a narrow strip separating Napeague Harbor from the Atlantic Ocean; from here the land rises abruptly into high rolling country, covered with pine and oak for about 2½ miles, till it reaches a height of about 125 feet. From this point the whole stretch of land to the east is visible, as well as the ocean on the south and the sound on the north. The descent to Fort Pond Bay is made in about 2 miles; hence the land rises, and drops again at Great Pond, 2 miles further on; thence it again rises into a rolling country somewhat broken, free from timber and covered with a fine natural turf, which extends to the extreme eastern point. Fort Pond divides the peninsula nearly in two; and Great Pond, over 2 miles long, is only a short distance from the northern shore and at right angles to it. Fort Pond Bay could be made a good deep water harbor, but at present is not protected in northerly gales.

In addition to the life-saving stations, and the light-house, the buildings within the limits of the land desirable for a proving ground consist of three small farm houses, and a cluster of eleven cottages, the last situated on a section of about 160 acres owned by an association of gentlemen, and used for summer residences.

The ground though rolling is not unsuitable for land ranges; those under 3 miles could be obtained with safety; one of 7½ miles and possibly more could be had from a point at the western end, but this would expose the cottages and the light-house to danger from erratic projectiles.

Perfect facilities are offered for safe ranges over water, it being possible to locate plane-tables at any desired point of the tract.

The buildings now existing would be of value for quarters, barracks, and stables.

The isolation of the site is complete, it being a peninsula off the line of travel, connected with inhabited parts of Long Island only by a narrow marshy beach.

The climate is healthy. In winter high winds might interfere somewhat with experimental work.

The tract is not included within the lines of any defensive works existing or projected.

The land, about 10,000 acres, was largely owned by Mr. A. W. Benson, of Brooklyn, recently deceased. He purchased it for $151,000; since then he has sold, as nearly as could be learned, between 200 and 300 acres. As he designed establishing a desirable summer watering place, he agreed in his sales that no objectionable buildings should be put upon the land sold, or to be sold. The estate is thus prevented from selling the body of the land without the consent of the Montauk

Association, which does not desire to sell its property. This company has erected on the 160 acres owned by it, buildings worth perhaps $125,000 to $150,000. Land in small lots is offered anywhere on the tract at $100 an acre; and in June, 1888, an option was given for one year to sell 1,000 acres of the most desirable portion, extending from shore to shore across the point, at $50 an acre. The wooded land at the western extremity is of much less value and is worth comparatively little, probably not more than $10 to $15 an acre.

(V) *Northern shore of Long Island from Greenport to Port Jefferson.*—This district is included between the northern shore of Long Island and the county road running at distances varying from half a mile to a mile and a half from the shore. Greenport and Port Jefferson are termini of branches of the Long Island Railroad, and are, respectively, 95 and 58 miles from New York City.

The land is not owned in large sections by any one individual, nor has it been offered to the Board for sale. The only means of reaching sites in this tract would be by a branch from the Long Island Railroad or by water, and for the latter there are few harbor facilities.

Between Greenport and Horton's Point no desirable location exists. From Horton's Point westward the country is more favorable, being a plateau about 100 feet above the sea. On account of intervening points a shore line of only about 4 miles is visible. The main county road, which is much traveled, runs nearly parallel to the coast, and midway between it and the railroad. The land is divided into small farms, and a large proportion is under cultivation. There are buildings to a greater or less extent upon each farm. Southhold Bay is a little over 2 miles distant from Horton's Point, and into it vessels of sufficient draught for the carrying of heavy guns can enter. The distance of Southhold Bay from New York is about 100 miles. If a site were selected, running west from Horton's Point to the Mattituck Hills, the firing point would be located near the light-house. There are ample facilities for water ranges, and a continuous land range up to 4 miles, which can perhaps be increased to 8, although the targets would not be visible from the firing point. A railroad would be required from Southhold Bay. It is regarded as impracticable to divert the county roads to the south of the railroad, so as to prevent travel on the proposed range, and without such diversion the strip of land is too narrow, being in places but a half mile wide.

The location is within the line of the possible defenses of the entrance to Long Island Sound.

The climate is similar to that of New York city, though somewhat cooler in summer.

The land is owned in small farms, and would cost on an average, including improvements, from $80 to $100 an acre. No effort was made by the Board to obtain definite propositions for sale, as the owners were so numerous, and the site was not deemed suitable for the desired purposes.

West of this section, from Young's Point to Herod's Point near Wading River, is another possible site. The continuous range here is less than in the location last mentioned. The country is more broken and in general is not so well adapted to use as a proving ground. Approach by water is much more difficult. The general character of the country is the same, although a less proportion of the land is under cultivation. The same difficulty exists as to county roads and deficient isolation.

The average price of land is about $75 per acre. It is held in small

From Wading River to Port Jefferson the land is not so suitable as farther east. The cost would probably average about $50 an acre.

(VI) *West shore of Peconic Bay southeast of Riverhead.*—A section extending from Canoe Place, on the Long Island Railroad, 2 miles along the shore and westward 10 miles along the railroad, was examined. Canoe Place is situated on the Sag Harbor branch of the Long Island Railroad, about 85 miles from New York City. About a mile north of this point is Squiretown, a hamlet of four or five houses, situated on Great Peconic Bay. Schooners of 10 feet draught can approach within a few hundred yards of the shore. The distance by rail to Watervliet Arsenal is about 230 miles, by water approximately 250 miles; rail transportation being by the Hudson River Railroad, and Long Island Railroad, and water transportation being by the Hudson River, Long Island Sound, and Great Peconic Bay.

At Squiretown is a bluff about 125 feet above the water, overlooking the country for some distance to the west. Forests prevented an estimate of available length. The surface is rolling, descending to the west. The soil is sandy and of little value for agricultural purposes, and uncultivated except near the railroad and along the shore. The location of the firing point would be on the hills at Squiretown. Adequate facilities are offered for water ranges, but it is very questionable whether the land would be visible for more than 2 miles westward, owing to other hills of about equal elevation.

The position is exterior to any existing or prospective line of defense. The proximity to the watering place of South Hampton would make a proving ground objectionable to the residents. Three county roads used to some extent, traverse the section in a generally northern direction. There is no natural barrier isolating the site.

Land in the immediate vicinity of Squiretown and along the railroad is worth from $25 to $50 an acre; in the interior probably it would not average more than $5 an acre.

(VII) *Site at Morgan, New Jersey, near South Amboy.*—This land was offered for sale to the Government by Mr. D. Noble Rowan. It is located on Raritan Bay, near the station of Morgan, N. J., on the Central Railroad of New Jersey, and can be approached by rail or water. By rail it is 30 miles from New York City, by water about 23.

Transportation from Watervliet Arsenal would be by the West Shore Railroad and the Central Railroad of New Jersey, distance 182 miles; by water by the Hudson River and New York Harbor, distance 175 miles.

The land offered for sale consists of an L shaped tract with less than a mile fronting on Raritan Bay and extending back about a mile perpendicular to it. The portion near the shore, and lying between it and the New York and Long Branch Railroad, consists of a plateau nearly a half mile long and three-eighths of a mile wide, overlooking the remainder of the land and well suited to the location of batteries for firing inland or to sea. North of the section is Cheesequake Creek, on the banks of which extends a salt marsh 8 or 9 miles back into the country and from 2 to 5 miles wide. This marsh could not cheaply be drained. The land range on the property offered for sale is limited to a mile. If the marsh also were purchased it would increase the length to 9 miles, but the tract thus added is not well suited to the purposes, as all projectiles falling therein would be lost. There would be sufficient water range, but it would not be possible to utilize it on account of the shipping in Raritan Bay and the lower bay of New York. There are but

two or three houses on the tract. The wagon road from Keyport to South Amboy and the railroad to Long Branch traverse the site.

The climate is similar to that of New York City.

The probable cost, if the salt marsh were included, was stated by Mr. Rowan to be about $1,000,000.

(VIII) *Site near New Egypt.*—This site, offered for sale by Mr. Frederick Mead, of New York City, is situated in southern central New Jersey, about 2½ miles east of south of New Egypt, the nearest railroad station, on the Pemberton and Hightstown branch of the Pennsylvania Railroad. The nearest supply station is Trenton, New Jersey, or more directly Philadelphia, which is distant 35 miles.

New Egypt can be reached by railroad from New York, which is about 65 miles distant, over the Amboy division of the Pennsylvania Railroad, or from Camden by the same road. A branch road 2½ miles would be needed from New Egypt to the proposed site to make it available. It could not be reached directly by water.

Transportation by rail from the gun factory at Watervliet Arsenal would be by the Delaware and Hudson Canal Company's road, thence by the West Shore to Jersey City, thence by the Pennsylvania Railroad system. The distance to Watervliet is about 215 miles. Transportation by water and rail would be by water to Bordentown, thence by rail. Guns going to sea-coast forts would be transported by rail to Bordentown or Camden, thence by water.

The site as first offered is irregular in shape, covering about 17,000 acres. The longest line (not quite 10 miles) is a diagonal from northwest to southeast. The eastern section is covered with sand hills, nearly 200 feet above the level of the western portion. The range would extend to the southeast, the firing point being near Brindletown. Such houses as are on the tract would be of no special value to the Government. Three roads that are somewhat used cross the tract, although it is claimed that they could be diverted. The western portion is extremely flat.

There are no adequate facilities for the testing of ordnance material in or over water, as the lake at Brindletown is not large enough for such purposes. There is no natural barrier to prevent the crossing of the tract or to isolate it.

The climate is similar to the rest of New Jersey—mild in winter and hot in summer. The location is an interior one, not requiring defense against bombardment.

The tract was originally offered for $100,000, but there were some "exceptions" on land sold within the outer boundary. Subsequently, Mr. Mead agreed to add such additional land as would give a range 2 by 10 miles at $10 per acre for the addition; he also offered to secure such "exceptions" as fall within his exterior boundary at the same price. The price per acre is less than half that offered elsewhere in New Jersey. Land in the neighborhood was held at from $5 to $50 an acre, according to location.

(IX) *The Wharton tract.*—This tract is situated in southern New Jersey, the southern extremity being near Egg Harbor City, and the northern about 30 miles from Philadelphia, which is the natural supply
[illegible]. The site extends 2 miles along the New Jersey Southern Rail-
[illegible]est of Harris Station. The only direct railway approach from
[illegible]rth is by this road. It has no facilities for direct water trans-
[illegible]on, Little Egg Harbor River, which runs within a few miles of
[illegible]thern boundary, being hardly available for use. Transporta-
from the gun factory at Watervliet Arsenal would be by

the Delaware and Hudson Canal Company's road, thence by the West Shore to Jersey City, thence by the New Jersey Southern; total distance about 235 miles. The most available point for reaching water transportation is Camden. Carriage from the gun factory by water would be by the Hudson River, Delaware and Raritan Canal to Bordentown, and thence to Camden.

This tract extends north and south between the waters of the Wading River and Little Egg Harbor River, Bull's Creek and its branches traversing it from north to south. The site as offered is 2 miles wide and from 10 to 12 miles long, as may be desired. There is considerable low land, which, it is claimed, can be easily drained. At the time the Board visited the site the season had been quite wet, and about 2 miles of the line cleared for inspection was largely under water, several places being impassable on horseback. The soil is sandy, and in most localities where covered with water the bottom is solid. From a point about a mile from the railroad the land drops from 10 to 30 feet, making this the natural location for the guns.

The site is sufficiently level for proving ground purposes, but it is questionable whether a full range of 8 miles could be overlooked from either end, even if the ground were cleared. Scrub pine and oak abound, requiring labor in removal annually. The general character of the land, as is usual in this part of New Jersey, is a sandy loam mixed with gravel.

There are no facilities for a water range or for testing any ordnance material in or over water. Such small buildings as exist would be of no value to the Government. Remoteness from business centers would be a source of annoying delays in the matter of supplies and emergency purchases. Several roads in general use cross the tract, most of which could probably be diverted. There is no natural barrier to prevent intrusion. The climate is mild in winter and hot in summer.

The site is offered at $20 an acre. Land in small lots has been sold in the neighborhood at from $20 to $30 an acre.

(X) *Site near Richland.*—This site is situated in the interior of south New Jersey, about 2½ miles from Richland, a station on the West Jersey and Atlantic Railroad, about 30 miles from Philadelphia, which would be the natural supply station. It has no direct water communication. Transportation by railroad from Watervliet Arsenal would be by the Delaware and Hudson Canal Company's road, the West Shore Railroad, and the Pennsylvania system from Jersey City; distance, 280 miles. Water transportation from the same point could be had by the Hudson River, thence by the Delaware and Raritan Canal to Bordentown, thence by the Delaware River to Camden, reshipment being necessary here. Transportation to the various forts on the sea-board would be by rail to Camden, thence by water or rail as seemed expedient.

The site is 10 miles long and 2 miles wide, less a triangular section cut from the northeast corner; it contains about 12,375 acres. It extends north and south along the divide between the waters of the Manumuskin and Tuckahoe Rivers.

The soil is mainly a sandy loam mixed with gravel. Small streams with some marsh land intersect the tract. The largest marshes lie about 2½ miles from the north end, others are at the southeast end. The land at the southern extremity is from 30 to 50 feet lower than at the northern, but does not allow direct drainage entirely within the property, as the axial line follows in general the divide, being broken in places by small streams heading therein. The whole section is covered by a growth of scrub-oak and pine, the former predominating.

The cost of clearing and grubbing would be from $15 to $20 per acre and would require renewal from time to time. The land is sufficiently level for proving-ground purposes.

The natural location for the firing point and buildings would be near the northern extremity, permitting a possible land range of over 8 miles. It is uncertain whether targets at one end of such a range could be seen from the other. When inspected by the Board a road parallel to the axial line and a little west of it had been cut through the scrub growth for about 4 miles, and drained by ditches on the sides. The whole extent of this road could be seen from its northern end. There are no facilities for a water range, or for testing any ordnance material in or over water.

Such small buildings as exist at present on the ground would be of no value for Government purposes. The remoteness of the tract from business centers would make the matter of supplies and emergency purchases a source of some trouble.

Three roads in general use cross the tract, one from May's Landing to Millville, one from May's Landing to Cumberland, and one from Hunter's Mill to Cumberland. The first named is the only one much used. Mr. C. G. Patterson, who offers the land for sale, agrees so to divert these roads as to prevent the necessity of transit. There is no natural barrier on any side to secure its isolation.

The climate, like all of interior southern New Jersey, is mild in winter but hot in summer. The mosquitoes would probably interfere with work more than the climate.

The land is offered by Mr. C. G. Patterson for $225,000. Mr. Patterson further agrees to build, free of expense to the United States, a railroad connection from the northern extremity to the West Jersey and Atlantic Railroad at Richland. Estimating the cost of the railroad at $25,000, the price of the tract conveyed would be about $17 an acre. The Board is informed that land has been sold in the neighborhood in small lots at about $20 an acre.

UNITED STATES ORDNANCE PROVING GROUND AT SANDY HOOK, N. J.

The existing proving ground, owned by the Government at Sandy Hook, N. J., is situated at the entrance to the lower bay of New York Harbor; the main channel passes within less than a mile of its northern extremity.

It can be reached from New York, the natural supply point about 20 miles distant, by the Central Railroad of New Jersey or by boat, in from one to two hours.

The Government dock is on the inner shore a few hundred yards from the point of the Hook; this is used exclusively for Government purposes. The railroad company has been permitted to erect a dock on the inner shore about 1½ miles from the first dock, for the accommodation of their steamers, and to this runs their road from points on the Jersey coast.

Transportation from the gun factory at Watervliet Arsenal by water is about 175 miles by the Hudson River and New York Bay. Vessels loaded at the factory deliver direct at the proving ground. By the construction of about 2 miles of railroad at Sandy Hook, deliveries could be made by rail from the factory about 185 miles through the Delaware and Hudson Canal Company's road, the West Shore Railroad, and the Central Railroad of New Jersey.

The distribution of cannon to points on the coast or in the interior can be effected by similar means without second handling.

The reservation consists of the entire peninsula of Sandy Hook, approximately 5 miles long and varying in width from about 100 yards at its southern part to about a mile near its northern end, the average width being about half a mile.

Along the outer shore, which is level and free from trees, exist ranges over land for low-angle fire up to about 4,500 yards, and for mortar or vertical fire up to about 6,500 yards. Back from the shore are sand dunes and higher ground, rising not above 25 feet. To the west of the line of fire, and about 1½ miles from the north end, is a small marsh. The railroad runs along the western shore from the neck at Navesink Highlands to the company's dock; the road is located by permission of the Government, but no rights have been ceded to the company.

No special provision would be needed for defensive works, as the general system for New York Harbor includes Sandy Hook.

The climate is similar to that of New York City, except that the winds are somewhat higher and there is more fog.

At the time the Board visited the proving ground, there were a machine and a carpenter shop for repairs, two store-houses, an office and instrument house wherein were located the various instruments for measuring the velocities of projectiles, quarters for officers, enlisted men and employés; and some other buildings belonging to the Government under charge of the Engineer Department.

The present experimental battery is situated near the northern end of the tract; the guns are mounted in part on permanent platforms and arrangements exist for the various classes of firing.

Long-range firing is had over water and is measured by the use of plane tables, one of which is situated at the battery and another at the Navesink Highland Light, giving a base-line of over 5 miles; though not quite as accurate or as satisfactory as if the firing were upon land, it is sufficiently so for all practical purposes. The water range is in the immediate vicinity of the battery, so that experiments with shell and shrapnel and with direct and ricochet fire can be carried on; the action of water fuzes, of high explosives in water, and, if desired, of topedoes, can all be advantageously experimented with here; also firing at fixed or moving targets. Some difficulty is experienced in firing, on account of fishing boats and other vessels getting within the dangerous zones.

RECOMMENDATIONS.

The Board is satisfied that the necessities of the service demand the immediate establishment of proving butts in the vicinity of the new gun factory at Watervliet Arsenal, and that the site selected among the sand hills west of Albany is not only suited to this purpose, but is the best available. It therefore recommends immediate purchase. The price should not exceed $75,000, judging from the present value of land in that vicinity as indicated by the options already secured, a list of which is appended, marked "A." Authority for condemnation should be granted to meet the case of possible exorbitant demands on the part of some of the many owners of the land.

The examinations made by the Board with a view to selecting a site for the general proving and testing of heavy guns, have covered all sites offered for sale or known to be available between Boston and Cape May, except such as have already been carefully inspected by former Boards and reported upon in the papers appended, marked "B" and "C," to which attention is invited.

The result of this exhaustive study of the subject may be summed up as follows: The present ordnance testing and proving ground at Sandy Hook, N. J., satisfies the requirements of a site for this purpose much more nearly than any other available within the limits stated.

The occupation of part of the western shore by the Long Branch and Sea Shore Railroad, however, has become inadmissible, in view of the extensive use of the range demanded by the resumption of work upon our seacoast defenses; of the longer range of modern high-power guns over any existing at the date when such occupation was authorized, and of the necessity for largely extending the area occupied by the works of permanent defense now projected at Sandy Hook.

The facts connected with the present occupation of the public land by the railroad in question are fully set forth in House Ex. Doc. No. 166, Forty-first Congress, second session. Authority to construct a road to a designated point near "The Cove" was granted by President Lincoln on July 21, 1864; and this permission was extended to "The Horse Shoe" by the Secretary of War on August 10, 1869. Since these dates the circumstances have been materially changed by the causes above stated.

The Board, therefore, recommends that this permission be now withdrawn, as may be done without hardship to the company, under the conditions affixed to the original grant. The railroad within the limits of the public land is not at present extensively used, and the Government must either be hampered or the public must be endangered for the benefit of a private corporation.

While Sandy Hook now affords sufficient facilities for the needs of the Government in the matter of testing and proving heavy guns, it is not impossible that in the future an additional site may become necessary by reason of the completion of the fortifications at Sandy Hook and their occupation by a garrison; and for this reason the Board has had in view the relative advantages and disadvantages of all the sites examined, well knowing that the cost will increase, and indeed that the possibility of securing such a site at any reasonable figure may become doubtful as time passes.

No site which requires consideration was found along the shores of Cape Cod between Provincetown and Nauset Harbor, as will be seen by consulting the above description of this district.

Near Point Judith a site exists which, except for the excessive cost and proximity to the established summer resorts of Narragansett Pier and vicinity, would require serious consideration; but for these reasons it must be regarded as unavailable.

The examination of the northern shore of Long Island from Greenport to Port Jefferson and of the west shore of Peconic Bay disclosed no site which in any degree fulfills the necessary conditions demanded by an ordnance testing and proving ground.

The site near Morgan, N. J., comes under the same category, and the cost under any circumstances would exclude it from consideration.

The three interior sites in New Jersey known as the Mead tract, the Wharton tract, and the Patterson, near Richland, possess similar natural features, and are all fatally defective in furnishing no facilities for water ranges. For this and other reasons, as will appear by comparing the requirements stated above for a suitable site for the object desired, with the detailed descriptions of these three tracts, they should be rejected without hesitation. As to their relative merits, compared with each other, neither of the more southerly sites possess superior advantages over the Mead tract, which is offered for a very much lower price.

The coast line between Sandy Hook and Cape May is so fully occupied by summer residences and places of general resort that no use could be made of lands in that vicinity for the testing and proving of heavy cannon, and detailed examinations were accordingly deemed unnecessary by this Board. The subject will be found discussed in the appended reports of former Boards. The same condition as to availability exists along the Connecticut shore of Long Island Sound.

The only sites examined by the Board, and which are found worthy of consideration as being of possible use for a proving ground in the future, are Fisher's Island and Montauk Point. The first of these is already occupied to such an extent by summer residences that it is believed that it would be imposible for the Government to acquire the entire island, and though three-fourths of the land might be obtained, an establishment thereon for the constant testing of cannon would undoubtedly be strenuously resisted. If this difficulty were removed, from the irregularity of the surface and the amount of stone upon it, at the best only land ranges more limited in extent than those at Sandy Hook, would be furnished, and more ranges over water would have to be used.

At Montauk Point the nature of the surface and the soil would offer no serious impediment to the location of land ranges of moderate extent, but the existence of the light-house at the Eastern end interposes an insurmountable impediment to obtaining a land range of even 6 miles in length; every line of fire must be selected with reference to the possibility of injury to this structure. Its existence is the principal difficulty which prevents the conversion of this site into a quite satisfactory proving ground.

Objection to the purchase of this property by the Government for such a purpose would be made by the owners of the summer cottages, and their land would, if necessary, have to be obtained by condemnation.

The entire land from Napeague Beach to the eastern point could doubtless be purchased much more readily and at not so great a cost as Fisher's Island, and when owned would give to the Government an isolated tract, moderately accessible, and which might be of immediate use as a summer encampment for troops, and be available in the future for a proving ground, should it be found that a military necessity called for the abandonment of the present establishment at Sandy Hook.

It is only when looking at what may be the needs of the Government in the future that it is deemed advisable to advocate now, whilst possible, the procurement by the Government of additional land somewhere on the sea-coast; and of all that lying north of Delaware Bay none seems to meet so well the conditions required as does the site on Montauk Point. The cost would probably be about $700,000.

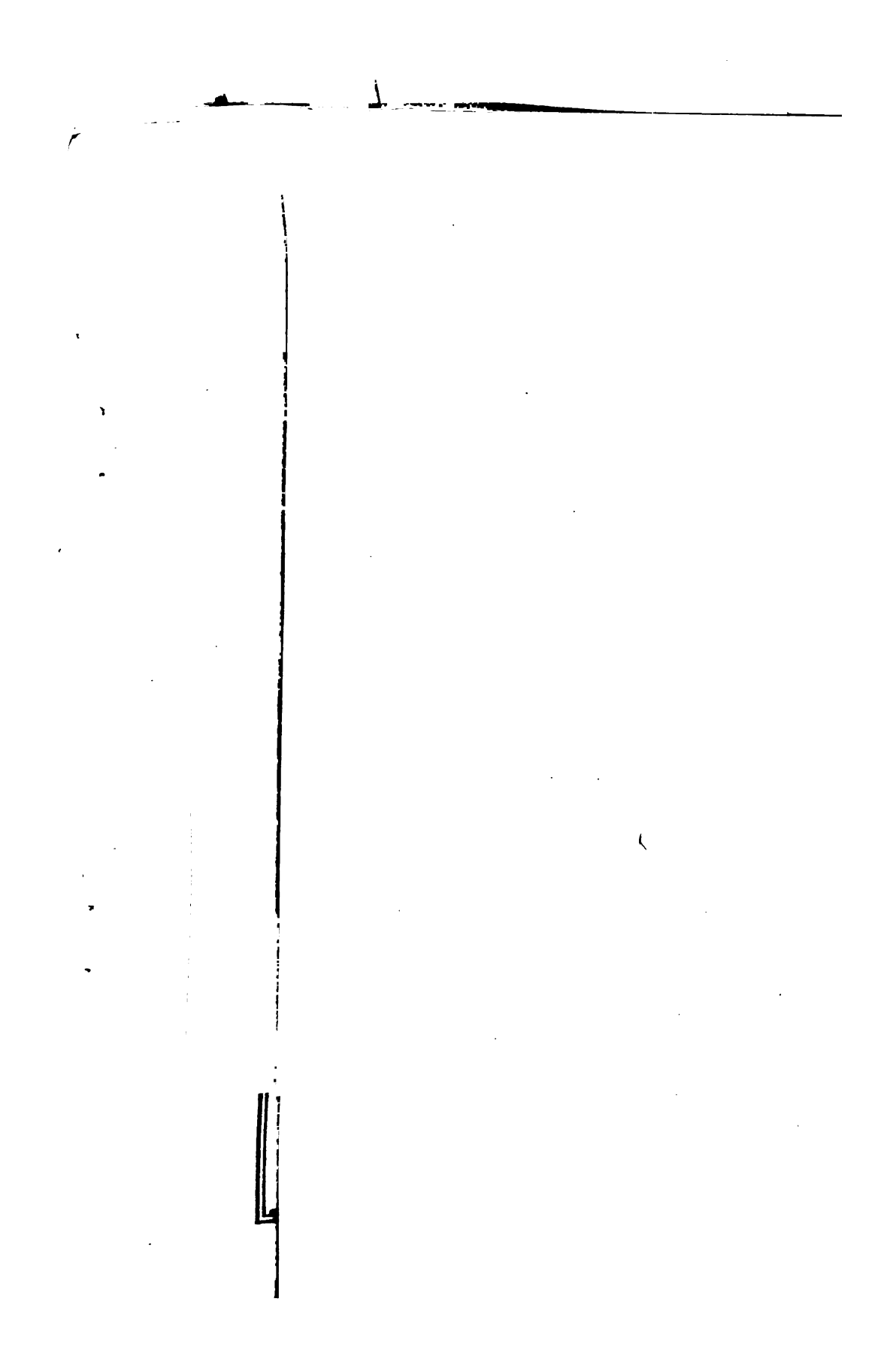
Respectfully submitted.

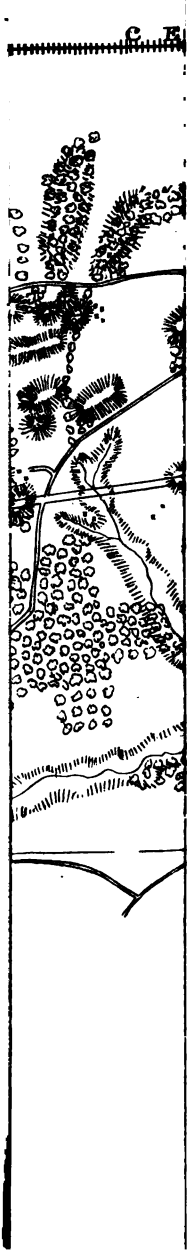
J. M. SCHOFIELD,
Major-General U. S. Army,
President of Board of Ordnance and Fortification.
HENRY L. ABBOT,
Colonel of Engineers, Brevet Brigadier-General, U. S. Army.
HENRY W. CLOSSON,
Colonel Fourth Artillery, U. S. Army.
A. MORDECAI,
Lieutenant-Colonel Ordnance Department, U. S. Army.

Hon. REDFIELD PROCTOR,
Secretary of War.

Appendices to report of Board of Ordnance and Fortification on sites for proving grounds.

A. Abstract of options obtained for grounds for sites.
A¹. Letter concerning same.
A². Map of same.
B. Report of Gillespie Board. (The Appendices to this report not sent herewith.)
C. Report of Greer Board. (The Appendices containing maps, etc., to this report not sent herewith.)
D. Map showing sites examined.




C E

APPENDICES.

APPENDIX A.

Abstract of options secured on land for proving ground near Watervliet Arsenal, New York, by the Board of Ordnance and Fortification.

Name of owner.	Acres.	Amount.	Name of owner.	Acres.	Amount.
John Bloomingdale	163.24	$4,897.20	Simon Hesner	100	$3,000.00
William J. Capron	32	800.00	John P. Kilmer	136.1	2,722.00
Daniel Casey	105	1,260.00	Abram Van Dyck and others	84.48	3,800.00
Jacob H. Clute	82.5	800.00	Henry Smith	72.2	1,810.00
Charles Coon and George Coon	217	8,246.00	Philip Smith and Isaac Anstadt	520	10,400.00
Charles Coon	114.75	5,737.50	Lyman Wiltsie	124	3,720.00
Patrick Dugan	111	4,440.00			

APPENDIX A[1].

ALBANY, N. Y., *January* 20, 1890.

GENTLEMEN: I have the honor to forward to you herewith options obtained by W. H. Slingerland & Son covering portions of the land northwest of Albany and south of the New York Central Railroad. Mr. Slingerland states as a reason for the unexpected high price of land that the question of moving the alms-house to the section had been talked of in the papers.

The railroad had also made some preliminary surveys with a view of possibly running a branch from Karner westward. Several parties had offered land north of Lydins road at $30 an acre but refused to sign an option. The majority declined to put any figure. Many claimed that as the railroad had bought a strip about 400 feet wide and about 2½ miles long adjacent to their road which they paid $75 to $150 an acre for, their land was worth the same. Mr. Armour, of Chicago, has just purchased 40 acres near Karner for which he paid $200 an acre, and has an option for 200 acres more at the same price. These recent purchases and the fact that the Government was the possible prospective purchaser, inflated prices.

The following analysis of options shows that land east of the line drawn west of Karner's Station at about $21.34 while that west averaged $33.20.

East of the line.

Name.	Acres.	Price.
H. Smith	72.4	$1,810.00
J. P. Bloomingdale	163.24	4,897.20
P. Smith & Anstadt	5.9	10,400.00
Daniel Casey	105	1,260.00
Total	860.64	18,367.20
Average per acre		21.34

ing
or sea-
water,
le, and
to test

West of the line.

Name.	Acres.	Price.
Dugan	111	$4,440.00
Wiltsie	524	3,720.00
Charles Coon	514.60	5,737.50
Vandyke	84.48	3,800.00
Charles and G. Coon	217	8,240.00
W. T. Clapron	32	800.00
J. Cinte	82.50	800.00
J. P. Kilmer	136.10	2,722.00
Hesner	100	3,000.00
Total	1,001.83	33,265.50
Average per acre		33.20

The distance to Karner's Station by the railroad guides is 8 miles from Albany or 5 miles from West Albany. Except for its being nearer to Albany the land from the water-works property to the proposed eastern boundary is better adapted to the purposes than that west thereof. Land along the railroad would now probably average from $50 to $75, that between it and the Lydins road probably from $30 to $50. The owners would not fix prices.

Very respectfully, your obedient servant,

C. C. MORRISON,
Captain Ordnance Department.

BOARD OF ORDNANCE AND FORTIFICATION,
Washington.

APPENDIX B.

Preliminary report of a board of officers upon the selection of a suitable locality for proving ground and for other purposes, limited to the examination made at Sandy Hook, New Jersey, and Island Beach, New Jersey, constituted by the following order:

Special Orders No. 122.

HDQRS. OF THE ARMY, ADJUTANT-GENERAL'S OFFICE,
Washington, May 26, 1888.

[Extract.]

* * * * * * *

17. By direction of the Secretary of War a board of officers, to consist of Lieut. Col. George L. Gillespie, Corps of Engineers; Lieut. Col. Richard Loder, Fifth Artillery; Capt. Rogers Birnie, jr., Ordnance Department, is appointed to meet at the Army Building in New York City on the 2d day of June, 1888, or as soon thereafter as practicable, for the purpose of determining upon a suitable locality for proving ground, and for other purposes, under such instructions as may be conveyed to the board by the Chief of Ordnance. The board will visit such localities in the performance of its duties as may be necessary. On the completion of the duty contemplated the officers named will return to their proper stations. Such journeys as may be required in complying with this order are necessary for the public service.

* * * * * * *

By command of Lieutenant-General Sheridan.

R. C. DRUM,
Adjutant-General.

Official:

O. D. GREENE,
Assistant Adjutant-General.

The letter was accompanied by a letter of instructions herewith, marked "B," prepared by the Chief of Ordnance May 31, 1888, inclosing for consideration House Resolution 156, Fiftieth Congress, first session, amended, herewith, marked "C."

The Board met pursuant to the above order 10 a. m. June 4, all the members present. Sandy Hook was visited June 5, and the afternoon of June 6 the Board proceeded to Island Beach, where the examination was completed by the afternoon of June 7.

It will be observed that the letter of instruction presented to the Board two points for investigation and report:

(1) The purchase of a certain tract of land in New Jersey for a proving ground.

(2) The lease of portions of Sandy Hook for hotel purposes.

The Board was further instructed to "determine how much of the Sandy Hook reservation can be given up for hotel purposes, should the ordnance proving ground be removed, outside of the land required for the forts, batteries, etc., contemplated for defense by the engineers; also how much can be given up for hotel purposes as above and still retain sufficient proving ground for ranges over land up to 4,000 yards, stating the advantages of such retention."

The joint resolution states that "the proving ground now in use by the Government at Sandy Hook is inadequate for testing heavy ordnance and solving the various experimental problems connected with gunnery," and that it is deemed expedient that the Government should acquire certain lands said to be suitable for said purposes on the coast of New Jersey, near Barnegat Inlet, offered to the Government by the United States Hotel Company for the sum of $200,000, provided the hotel company could secure another location available for its proposed buildings, which location is further defined as a part of the Government reservation at Sandy Hook. In other words, the United States Hotel Company, if authorized to lease for hotel purposes for the period of ninety-nine years, with provisions for future renewals, a certain part of the Sandy Hook reservation, will sell to the Government in lieu thereof, a certain other tract of land lying on the coast of New Jersey, near Barnegat Inlet, known as Island Beach, for the sum of $200,000.

This proposition, if accepted by the Government, would require the existing proving ground at Sandy Hook to be broken up at great expense of time and money, and all the buildings and plant to be transferred to Island Beach.

In order to form a conclusive judgment between Sandy Hook and Island Beach as suitable sites for a first-class proving ground, the Board established a standard of comparison which embraced accessibility, isolation, topographical fitness, and healthfulness. These qualifications are more particularly described and defined as follows:

(1) *Accessibility.*—The site should be accessible by rail, and especially by water, for easy and cheap transportation of guns from the point of manufacture to the proving grounds and thence to their destination at distant forts, gun appliances, and all war material and devices which may be required to be tested or experimented with before adoption for general or special use; it should be accessible to machine and repair shops; otherwise expensive plant must be built and maintained at the site at a great expense for original outlay and annual repairs; and it should also be convenient to a good market for the purchase of all articles required at the station for experiments or for the subsistence of the laboring force.

(2) *Isolation.*—The site must be isolated from towns, villages, pleasure resorts, and agricultural districts, and not traversed by lines of ordinary commercial travel, so that operations may be carried on without endangering life and property.

(3) *Topographical fitness.*—The site should be preferably on the sea coast, where a range of sufficient length may be obtained without opposing obstructions, and so directed that the missiles may be recoverable; the surface should be comparatively regular, requiring small expense for gradation; sand should be abundant for making butts, and the sea near at hand for the use of floating targets or securing extreme ranges which may be impossible on land, also for experiments with torpedoes of every class. It should be sufficiently capacious to contain all necessary buildings, such as magazines, laboratories, repair shops, observation towers, butts, bomb-proofs, railway tracks, shell sheds, etc. It should also be located upon a harbor accessible at all times from the sea by naval and merchant vessels of the largest class, where secure and quiet anchorage may be had, and where experiments with torpedoes, water or aërial, may be made with facility, dispatch, and immunity from danger.

(4) *Healthfulness.*—The environments of the locality should be such that the site will not be subject to epidemics or long-continued malaria, so that work may be conducted uninterruptedly throughout the year with least exposure to the personnel of the post. The following is a concise description of the two sites:

SANDY HOOK.

The accompanying map of Sandy Hook shows the situation and extent of the Government reservation and the location of the buildings, etc. It is distant about 20 miles from New York City over a course navigable for the largest vessels and lying entirely within the line of outer defenses for New York Harbor. The present dock facilities at the Government landing can be easily made secure and accessible for discharging or loading sea-going vessels capable of transporting the material required for seacoast armament to any part of the coasts of the United States. Deep and still water, providing safe anchorage for the vessels, is found close at hand on the bay side, and there exists unlimited facilities for water ranges of guns and for experiments to test

the effects of projectiles intended to defend the coast against the advance of hostile ships of war.

The length of the reservation is 5 miles, nearly. The width of the northern portions averages somewhat over one-half mile, increasing to about 1 mile near the middle length. At the south the land contracts to a narrow neck of sand averaging about 100 yards in width over a length of three-fourths of a mile. This configuration of the land lends itself in a remarkable degree to contribute to the necessary isolation of the locality. The land is nearly level and naturally well graded for general purposes; and ample and suitable space is at hand for the construction of buildings or other works required. The range is located near the ocean beach and the line of fire extends southward; there is a safe and suitable range over land for low-angle firing up to about 4,500 yards, and for mortar or high-angle firing up to about 6,600 yards.

Should it be deemed necessary at any time to supplement the ample facilities for water transportation, it would require the laying of about 1¼ miles of railroad track of easy construction.

ISLAND BEACH.

Island Beach is a long and narrow sand-spit which separates Barnegat Bay from the Atlantic Ocean, on the New Jersey coast, 50 miles south of Sandy Hook. The portion which the United States Hotel Company suggests as a proving ground is 8.2 miles long approximately, and extends from a point near Life-Saving Station No. 13 southward to Barnegat Inlet. It is deficient in many essential features.

"There is no suitable harbor in the vicinity. Not more than 6 or 7 feet can be carried at mean-low water over the bar at Barnegat Inlet, which is described by the United States Coast Survey as follows:

"'It is a little over one-half mile wide at the entrance, but this space is nearly all occupied by dangerous shifting sand-shoals, which extend off to seaward for a distance of nearly 1 mile and render all attempts to enter the inlet extremely hazardous for those who are not competent local pilots.'

"The locality is very inconvenient of access and is entirely destitute of wharves, buildings, emplacements for guns, etc., to provide which would involve a large expenditure." (Report of Board of Engineers for Fortifications hereto appended, marked "D.")

The site is 70 miles distant from New York City and 60 miles from Philadelphia, with which cities it has connection by a single-track railway, which would have to be strengthened at once, especially at bridge crossings, undoubtedly at Government expense, too, to adapt it for the transportation of single weights equaling 54 tons, the maximum weight of a single modern gun built by Government. Barnegat Bay has an average depth of 7 to 8 feet, and the channel is on the west side, 4 miles from Island Beach. It has no value whatever as a harbor for any kind of war vessel. The average width of Island Beach does not exceed 1,400 feet—the minimum width being about 1,000 feet. The surface of the beach north of the head of Barnegat Bay selected by the board of 1875 is comparatively regular and continuous, but Island Beach, from end to end, is distinctively irregular and broken. The dunes are well-marked and distinct hummocks, separated at frequent intervals by broad and deep swales extending directly across the spit from the ocean to the inside bay, furnishing water-ways for the seas which sweep over the beach during extreme high tides or when driven against the shore by strong easterly storms. The trough of these swales is a foot or more below average high water and has generally a bulkhead of 10 to 15 feet thickness separating it from the ocean, while the crests of the hummocks rise to heights above high-water plane varying from 10 to 20 feet. Along the upper part of Island Beach the outer faces of the highest hummocks are close up to the high-water line with a somewhat steep foreshore, but along the lower part they lie well over to the west side, with smaller ones in front in the direction of the ocean, showing a more recent formation.

To fit the beach for a suitable range, as well as a site for targets, platforms for guns and for buildings, the hummocks would have to be graded into the swales and leveled up and protected so as to provide a permanent level 10 to 12 feet above the high tide.

It is impossible to estimate accurately the cost of doing the work, but it will not be at less rate than 16 cents to 20 cents per cubic yard for material moved up to 1,000 feet.

The reduced width of the spit—only 1,000 feet wide at places—makes the site ill adapted to the convenient location of buildings for the service of the station, after making suitable reservation for railway tracks and switches. It is to be remarked, also, that two life-saving stations are located upon Island Beach, which could not safely be occupied by families during firing; that the Beach is not sufficiently long to give the extreme range required on land, and that if the range which could be located on Island Beach could be prolonged to 9 miles from the firing point, its terminus would fall dangerously near the populous settlement south of Barnegat Inlet.

When the two sites were carefully and thoughtfully measured by the adopted standard the Board arrived at the decision that Sandy Hook is the more eligible site, in each and every particular, for a first-class proving ground, and that it would be inadvisable, inexpedient, and eminently injudicious, both as regards local and national fitness and economical expenditure of public money, to change the existing proving ground from Sandy Hook to Island Beach.

LEASE OF PART OF THE SANDY HOOK RESERVATION FOR HOTEL PURPOSES IN ITS RELATION TO FORTIFICATIONS.

This reservation was originally required for military and other public purposes, and with commendable foresight its boundaries were fixed with the view to provide ample facilities to meet the future defense of the outer harbor of New York City. The wisdom of this action is now recognized by those whose province it is to prepare projects for the fortifications of the sea-board. The Board does not feel competent to decide how much of the reservation at Sandy Hook is needed for fortifications, batteries, etc., but for information on this subject it invites attention to the accompanying report of the Board of Engineers for Fortifications, addressed to the Chief of Engineers, U. S. Army, dated April 25, 1888, which states emphatically, without reference to a proving ground, that "all of the land (Sandy Hook Reservation) is required for sites of fortifications and for firing to determine the proper thickness of iron armor, masonry, etc., required in their construction, for experiments with high explosives, and various other matters connected with coast defense." Inclosure herewith, marked "D."

The late printed reports of Boards convened by Congressional resolutions indicate to the present Board that the Government is on the eve of the adoption of the modern system of defense for our harbors, which will require the greatest amplification for sites for turrets, forts, ba teries, and all kinds of defensive arrangements.

The special project for the proposed fortifications at Sandy Hook is not accessible to the Board, but an attentive reading of the report of the permanent Board of Fortifications just referred to impresses the Board with the conviction that no part of the reservation at Sandy Hook can be transferred to private parties without manifest injury to the service. The armament of modern defenses, unlike those which were discarded twenty years ago, will not all be concentrated in masonry structures, in several stories, covering restricted sites, as unprofessional persons seem to think, but will be distributed over detached sites, a few guns only at each site, and so disposed as a whole that while their fire may be convergent upon the lines of approach of the attacking party, that of the enemy must be divergent. This principle applied at Sandy Hook would require, in the opinion of the Board, the greater part of the available sea-coast frontage of the reservation for turrets, batteries, and other defensive expedients, inclusive of mortar batteries, reserving the narrow part of the high ground at the southern boundary of the reservation for sites for barracks for troops, stables for public animals, store-houses for supplies of war material, and for other needful purposes, as remote as possible from the fire of the attack, for the use of a large garrison, which will be demanded for land defense and which will form a necessary adjunct to the permanent defenses on the eastern and northern sea fronts. It is imperatively necessary, therefore, that the southern part of the reservation should be absolutely free from private trespass or occupancy. These are the conclusions of the Board, whether the proving grounds are retained at Sandy Hook or not, and whether a long or only a short range is procurable there. The Board is of the opinion, however, that it would be best to retain the proving grounds where they are under the direct protection which will be afforded by the fortifications of the site, apart from the special eligibility of Sandy Hook for the efficient, economical, and convenient experiments with heavy guns and other war devices, which the Board has clearly set forth in another part of this report.

The establishment of an efficient range with all necessary appliances and buildings is feasible and practicable at Sandy Hook, without interference with the projects for defense, and the union of the two branches of the service upon the same grounds will inure to the advantage of both by permitting each to witness and benefit by the experiments of the other, and will be more economical in the expenditure demanded for buildings and plant during the construction of the defenses and while making experiments either for proof of guns or for determination of thickness of armor and masonry, etc., for coast defenses.

LEASE OF PART OF SANDY HOOK RESERVATION IN RELATION TO PROVING GROUND.

The Board finds that no portion of the Government reservation at Sandy Hook can be given up for hotel purposes, and at the same time retain at that place a proving ground which will provide ranges over land up to 4,000 yards.

The striking advantageous feature which Sandy Hook now possesses as a site for a proving ground is its isolation and the freedom from danger to persons and prop-

erty from the firings. This feature is secured by the present configuration and peculiar location of the reservation and its limited occupation by outside parties under the rules and regulations established by the Government to prevent trespass; and this feature can only be retained by the Government maintaing the present control of the whole of the reservation. The narrow neck of land, now owned principally by the Government, connecting the Hook with the mainland at the south is a strip of sand difficult of access and traversed only by the railroad which lands no passengers except at the dock on the bay shore. Should the occupation of any portion of the reservation be permitted for hotel purposes, the isolation of the tract would be destroyed. It would be difficult if not impossible to prevent persons from trespassing upon the portions of the beach or land reserved to the Government, and there would be a constant danger to injury from the firings. There would also be the possible danger of the landing of projectiles from erratic flight within the portion ceded for hotel purposes, and the dangerous area would be much increased by the use of the water in front of the ceded area by bathers and boats of various description. The clear sea area at present available makes it feasible and entirely safe, with due care exercised, to fire over-land ranges up to 4,000 or 4,500 yards.

The advantages of retaining Sandy Hook as a proving ground—limited though it may be to ranges up to 4,000 yards overland—taken in connection with such information as the Board has as yet been able to obtain with regard to any other possible site, are such as to lead the Board to express the earnest conviction that such retention is advisable and that any measure looking to the relinquishment of this proving ground at the present would seriously interfere with the operations of the Government.

The accessibility of the place to the establishments that will probably furnish the guns, carriages, armor, and other materials for trial and proof, and its facilities as regards transportation of all this material both from points of supply and to points of final destination are probably superior, in point of means, time and economy to any other possible location.

The Board has elsewhere cited these advantages and also those of the convenient harbor for trials of torpedoes of various kinds, all of which must be operated in navigable waters. It is deemed highly important that a proving ground should afford all necessary facilities for testing water-fuzes used in connection with aërial torpedoes and with projectiles with dangerous bursting charges fired to sea.

A proving ground at this place will be under the direct protection of the forts and batteries which must be erected there for the defense of New York Harbor, in this respect affording a decided advantage over any equally exposed site on the coast which, unless provided with defenses, would be open to easy bombardment by hostile vessels and probably entail an entire abandonment of the site in time of war, and the cost of removal or the destruction of much valuable material.

No expense for such supplementary defenses would be required at Sandy Hook.

The economy to the Government, in the matter of immediate expenditure, in retaining a proving ground at Sandy Hook need scarcely be dwelt upon. But it may be pointed out that there is now a machine shop for repairs, an office building with instruments and appliances fixed for taking velocities, etc., various platforms for guns including two of concrete, targets, sand-butt for proof firing, a substantial brick building for officers' quarters and quarters for foreman and the enlisted men employed at the station, and a Western Union telegraph office and observation tower for sighting vessels: there is a considerable amount of material which would require removal if the proving ground were abandoned and the establishment of a new proving ground would require the renewal of appliances now operative at Sandy Hook.

The sea ranges at Sandy Hook are measured by plane table. Whatever deficiency may have heretofore existed in this respect appears to have been fully met by the recent establishment of one extremity of the measuring base at the Navesink Light. This gives an ample base length to get good and sufficient angles from the sea range.

Upon the question of the expediency of retaining at Sandy Hook a land range up to 4,000 yards; the Board concludes that the present situation at Sandy Hook substantiates the following proposition, viz: There would exist ample facilities for all the firings required on a first-class proving ground except in a few comparatively unimportant particulars; there would be in other words a limited land range of the extent named and an unlimited sea range. An exception noted is that the projectiles fired at long range—necessarily to sea—could not be recovered. On this point, however, the investigations of the Board made at Sandy Hook show that it is difficult and often impracticable to recover projectiles fired on land which sink deep into the sand as in the case of high angle firing. This difficulty would probably be found on any low-lying, sandy, seacoast site, as it appears that at the Barnegat site the sand is found to be saturated with water at a less depth than at Sandy Hook. The exges of all guns can be determined by firing to sea and if the longest range y at vertical targets is required, the target can be floated as is now t some of our artillery posts on the seaboard.

The amount of firing required to be done at a proving ground beyond a range of 4,000 yards is relatively small; hence the importance, in the matter of economy of recovering the projectiles fired beyond that range is not great. Much the larger part of all the firings is done at the proof-butt at very short ranges and the projectiles are recovered from the butt.

The 4,000 yards range over land, which includes several hundred yards more of land lying beyond in the line of fire, will afford scope for all the firings absolutely necessary to be made over land; it is about the extreme range at which siege guns and projectiles need be tested for accuracy, and of course embraces the ranges for field guns. It affords scope also for testing the effect of every caliber of projectiles on earthworks and on armor; the conditions of loading and firing may, as would generally be done even on a more extended range, be made to assimilate the conditions of firing at full ranges with full charges of powder.

The report of the Board on Arsenals, of 1875, page 602, annual report Chief of Ordnance, 1875, made before the establishment of the present proving ground and now referred for the information of this Board, states the following objection with reference to the use of the reservation at Sandy Hook as a proving ground, viz:

* * * "It is entirely too contracted for all our uses, and the Long Branch railroad limits and materially interferes with its usefulness as an experimental firing ground." * * *

The continued use of the place as a proving ground during the past ten years has afforded opportunity to test and determine its facilities and suitableness. It can now be said with full understanding, that the place has proved adequate in the past and affords natural facilities suited to a large expansion of the present work and the maintainance of an excellent proving ground.

G. L. GILLESPIE,
Lieutenant Colonel Engineers.

R. LODOR,
Lieutenant Colonel Fifth Artillery.

R. BIRNIE, Jr.,
Captain Ordnance Department, U. S. Army.

The CHIEF OF ORDNANCE, U. S. ARMY,
Washington, D. C.

APPENDIX C.

Report of the Board of Ordnance Officers convened to select a site for a proving ground by the following orders:

Special Orders, No. 156.

HDQRS. OF THE ARMY, ADJUTANT-GENERAL'S OFFICE,
Washington, July 7, 1888.

[Extract.]

* * * * * * * *

2. By direction of the Secretary of War a Board of officers of the Ordnance Department, to consist of Captain Cullen Bryant, Captain John E. Greer, Captain Rogers Birnie, jr., is appointed to meet in New York City on Thursday, July 12, 1888, or as soon thereafter as practicable, for the purpose of selecting a site for a proving ground. The Board will be guided by special instructions to be given by the Chief of Ordnance, and the Board, or the individual members thereof, will make such journeys as may be necessary under such instructions. Upon the completion of the duty contemplated the members of the Board will rejoin their proper stations. The travel enjoined is necessary for the public service.

* * * * * * * *

By command of General Sheridan:

R. C. DRUM,
Adjutant-General.

Official:

J. C. KELTON,
Assistant Adjutant-General.

Special Orders, No. 168.

HDQRS. OF THE ARMY, ADJUTANT-GENERAL'S OFFICE, *Washington, July* 21, 1888.

[Extract.]

* * * * * * *

4. By direction of the Secretary of War, Captain Frank Heath, Ordnance Department, is detailed as a member of the Board of Officers appointed by paragraph 2, Special Orders, No. 156, July 7, 1888, from this office, *vice* Captain Cullen Bryant, Ordnance Department, hereby relieved from further duty as a member of said Board.

* * * * * * *

By command of General Sheridan:

R. C. DRUM,
Adjutant-General.

Official:

J. C. KELTON,
Assistant Adjutant-General.

The Board met pursuant to the above orders. The record of its proceedings are herewith appended marked A. On the dates and in the order specified therein, the Board visited and carefully inspected the following named places, proposed as sites for a proving ground, viz:

(1) The valley of the Rockaway River from Berkshire Valley northeast to Petersburgh, N. J.

(2) A tract of land near Richland, N. J.

(3) A tract of land near Elwood, N. J., known as the "Weymouth tract."

(4) The "Montauk tract" at the eastern extremity of Long Island.

(5) A tract of land near Atsion, N. J., known as the "Atsion tract" of the Raleigh Land and Improvement Company.

(6) A tract of land near Albany, N. Y.

And the Board also visited and inspected the present proving ground at Sandy Hook, N. J.

The special instructions of the Chief of Ordnance to the Board, by which it was to be guided, with accompanying papers transmitted therewith, are herewith inclosed marked B^1 to B^6. By these instructions the site selected for a proving ground should fulfill the following requirements:

(1) It should admit of open ranges of from 8 to 10 miles preferably over land.

(2) It should have a width of from 1 to 2 miles, if inland, depending upon location and topographical features.

(3) It should be adapted to the erection of the necessary structures, as shops, offices, and quarters, platforms for heavy guns, of either masonry or timber, railways and roads, telegraph and signal communications.

(4) It should be adapted to the various kinds of fire from field as well as from heavy guns, and to the various tests of projectiles, earthworks, and armor-plates.

(5) It is desirable that it should possess facilities for the test of shell to act under water.

(6) It should be comparatively level, easily accessible, not traversed by important highways or water-courses; remote from settlements to avoid encroachment and danger of accident or damage to private property.

(7) It should have convenient communication with the establishments that will furnish guns, powders, projectiles, etc., for trial and proof, and should possess ample facilities as regards transportation, both by rail and water, from points of supply and to points of final destination.

(8) It should stand in proper protective relation to the system of coast and frontier defense.

The instructions also name the following public and private establishments from which supplies are or have been recently procured, viz: Watertown Arsenal, Watertown, Mass.; Frankfort Arsenal, Philadelphia, Pa.; West Point Foundry, Cold Spring, N. Y.; South Boston Foundry, Boston, Mass., and Dupont's Powder Mills, Wilmington, Del. The Board also deemed it proper to consider that the Cambria Iron Works, Johnstown, Pa.; Bethlehem Iron Works, Bethlehem, Pa., and the Midvale Steel Works, Philadelphia, Pa., are probable sources of supply for guns, projectiles or armor. It is also noted that since the issuance of these instructions a law has been enacted authorizing the erection of the necessary buildings and structures for an army gun factory at Watervliet Arsenal. Finally the Board is required by its instructions to state whether the site or sites it may visit are preferable or otherwise [illegible] present proving ground at Sandy Hook; and if it should find one or more sites to furnish an estimate of the prices for which they can be procured and nount necessary to provide adequate means of communication to and from e, with the great lines of rail and water transportation.

The Board submits the following descriptions of the sites visited, with its action in each case, respectively:

VALLEY OF THE ROCKAWAY RIVER.

This valley is situated in the northern part of the State of New Jersey. From the hamlet of Berkshire Valley it extends in a tolerably straight line northeasterly toward and somewhat beyond Petersburgh. It has high mountains on both sides, and is traversed by a single road, which could probably be vacated if necessary.

The Rockaway River is a small stream, except at intervals where it is set back by dams for water power no longer used. In the valley a few settlements have been made in the past, but they are now almost entirely abandoned and would offer no obstacle to its purchase by the United States. The practicable length for the purposes required would fall somewhat short of 8 miles. In width the valley varies from one-quarter to half a mile, except at its upper end, where it opens out into a more rolling country. The high mountains at its sides prevent its being intersected by cross-roads, and afford a natural boundary which would protect it from encroachment by settlers. It was this feature, in connection with the fact that it is in close communication with the United States (Dover) powder depot, that induced the Board to examine it.

This range has fairly convenient railroad facilities: the New York and Susquehanna crossing the line about 2 miles above the northwestern limit, and the Morris County Railroad approaching within 1 mile of its southwestern boundary. The valley is much cut up by spurs projecting from the surrounding ranges and by several hills in its middle at intervals throughout its entire length. The upper portion is especially rough and rocky in character, so much so, taken in connection with its restricted length, as to lead the Board to the conclusion that it is unsuitable for use as a proving ground.

ATSION.

Atsion is situated near the center of the southern portion of New Jersey, at the junction of the Philadelphia and Atco branch and the main line of the New Jersey Southern Railroad. It is 27 miles from Philadelphia and 79 from New York. This town was formerly of some prominence, containing a large cotton-mill, grist-mill, saw-mill, seventeen cottages, fifteen factory houses, and a large mansion, the home of the owner of almost the whole town. For several years no work has been done there and the place is rapidly falling into decay.

The proposed range at this point is contiguous on its south side to the New Jersey Southern Railroad its entire length of 9¼ miles. Its north side is parallel to the railroad, which runs north of east, and is 2 miles from it. Its eastern boundary is a highway leading to Harris Station on the railway. Neither road nor station is of any prominence. The western boundary is a road known as the Medford road, crossing the railroad just east of the town of Atsion.

This tract of land is intersected by several streams with marshy borders within 3 miles of the assumed location of the guns, and a little farther on two large cranberry bogs occur. The land is in general rather low lying and liable to retain the water due to rain. It is covered with a small second growth of pine, cedar, and scrub-oak, the cedar being found near the streams. The chief advantages presented by this land are found in the fact that many buildings exist which might be utilized as quarters, offices, shops, etc., and also that it has convenient access to the railroad throughout its length. It is believed, however, that these advantages are more than neutralized by the swampy character of the land at points necessarily most frequently used. The site is, therefore, not deemed suitable by the Board for a proving ground.

WEYMOUTH.

This tract, owned by Mr. C. R. Colwell, of Weymouth, N. J., is situated in the southeastern part of New Jersey, about 33 miles from Philadelphia. It lies between the Philadelphia and Atlantic and Camden and Atlantic Railways on the north and east and the West Jersey Railway on the south. The first-named road constitutes a part of the Reading and the last two a part of the Pennsylvania system.

A choice of three ranges was offered the Board by Mr. Colwell. Of these but one, the most easterly, was considered worthy of examination, the others being too short for the purpose. The one examined lies contiguous to the Philadelphia and Atlantic Railway for about 4 miles of its length, while the remaining portion of the same site does not greatly diverge from it. A range of about 9¼ miles can be obtained, starting at Elwood, the nearest railway station on the Philadelphia and Atlantic and Camden and Atlantic Railways, and running to the southeast. The nearest station on the West Jersey Road is May's Landing, which is about 2 miles to the west of the termi-

nal point of the range. May's Landing is the head of navigation on the Great Egg Harbor River. Vessels of from 100 to 150 tons ascend to this point.

One important road, the May's Landing and Egg Harbor City, crosses the proposed line of fire at about 4½ miles from Elwood. It is understood, from correspondence with Mr. Colwell, that this road can be vacated. An unused railway runs parallel to it and connects the two towns. From its direction it could not be made of any special value to the United States.

The land is in general quite level. It is covered with pine and cedar, mostly of small second growth, though there is a considerable quantity of large timber still standing, particularly of white cedar. The ground is somewhat cut up by streams with low marshy borders which are especially objectionable as they occur within the portion that would be most frequently used. The soil is a sandy loam and the land is regarded as desirable for farming purposes when the timber is removed.

The chief advantage possessed by this range lies in the fact that it has two competing railways but 200 yards apart at its upper end, and a railway and a small river at the other.

The price asked by Mr. Colwell, $25 per acre, is materially higher than that of another equally good and possibly better range examined by the Board, though the latter has not the advantage of competing roads. Owing to the system of pooling adopted by most railways, this supposed advantage may be entirely illusory. In addition, the practicable range that could be obtained would be materially shorter than the one above referred to as the guns would have to be advanced some little distance from Elwood. The Board does not, therefore, recommend this site as suitable for a proving ground.

ALBANY.

This site is located between the cities of Albany and Schenectady, on the line of the New York Central and Hudson River Railroad. It comprises the greater portion of the high land or divide which separates the valleys of the Hudson and Mohawk Rivers between the two cities named. The soil is principally sand, covered more or less thickly with scrub oak, pine, and huckleberry, with here and there patches of timber of considerable height. A ridge of hills, estimated from 20 to 60 feet high, extend nearly the entire length of the available site, with spurs jutting out at various points, necessitating considerable grading on the line of the proposed range which is marked on the accompanying tracing. The land in the vicinity of Albany is uncultivated and is of little value; towards Schenectady the soil improves, and numerous small farms are to be found in the level portions between the hills. Although the cities named are 17 miles apart, yet owing to the necessity of locating the firing point a sufficient distance from Albany to avoid damage and disturbance to that city, and the fact that in the vicinity of Schenectady important highways exist which can not be closed, the available range would be limited to about 6 miles. This ground is easily and quickly accessible from the Watervliet Arsenal by means of the Delaware and Hudson and New York Central Railroads. The advantages of location due to this fact are evident. The Board, however, on account of its limited range as explained above, does not recommend it as a suitable site for a proving ground.

MONTAUK.

Montauk is situated at the extreme easterly end of Long Island. It is about 10 miles in length, and varies in width from 1 to 3 miles. It rises quite abruptly from Napeague Beach, a low, sandy strip extending from the eastern shore of Napeague Harbor back to the town of Amagansett, a distance of about 5½ miles.

About 2½ miles from the western end of Montauk the land reaches its highest elevation, fully 125 feet or more, and from thence a command is given over the ocean, the sound, and the land itself to the extreme end of Montauk Point, at which the light-house is distinctly visible. A tolerably abrupt descent leads from the high ground to Fort Pond, a sheet of water about 2½ miles from the assumed position of the guns, lying across the proposed line of fire. The land rises almost immediately on the opposite side, and continues in a general level, though over a somewhat rolling country, to Great Pond, where there is a moderate depression, thence on to the light-house. The latter portion is somewhat rough and rocky, particularly along the line of the road which skirts the shore and overlooks the ocean. The soil is a firm admixture of sand, gravel, stone, and earth. The whole area is covered with grass, and is used as a range for cattle and sheep.

Within the limits of the proposed firing ground there are about three buildings, two being keepers' houses and one a stable near Great Pond, except on a bluff overlooking the sea, where nine cottages have recently been erected for summer occupancy. These could not well be utilized by the Government in their present position, as they are only about half a mile from the line of fire. It is possible that they

might be taken down and again put up on the northeastern shore of Fort Pond Bay, overlooking the Sound.

At present heavy guns can only be transported to Montauk by water, the landing to be made at Fort Pond Bay. It may be well to mention that this bay has abundant depth of water for the largest ocean steamer, and that but a short time since a plan was under consideration by which five-day European steamers were to be run from this point, the Long Island Railroad completing the communication with New York. The nearest station of this road is now at Bridgehampton, about 21 miles from the point at which the guns could be located. The nearest telegraph station is at Amagansett, 10 miles from the same point.

Montauk may be reached by steamer from Sag Harbor, the terminus of the Long Island Railway on the Sound. It may also be reached by steamer from New London, Conn. The distance is about 23 miles.

As a site for a proving ground Montauk possesses many advantages.

From the assumed firing point to the light-house is 7½ miles, but the necessity of avoiding the latter would slightly decrease this distance for the actual range. The ground is high pretty much throughout its whole extent. It is almost entirely free from mosquitoes, which are found in such abundance on Napeague Beach as to prevent the possibility of encroachment from that direction. In addition, that beach is too low and wet to admit of occupancy. With the whole of Montauk in the possession of the Government nothing would prevent its full utilization as a range except the light-house, the life-saving stations, of which there are three, being situated under the bluffs and therefore not exposed to danger.

The transfer of guns from Fort Pond Bay to the firing point would offer no particular difficulty, though some grading would have to be done along the line of the more or less natural range between the hills.

The command over the sea, in addition to that over the land, is especially advantageous.

The most serious objections to Montauk consist in the fact that at present it is not particularly accessible except by water, and that it does not stand in proper protective relation to the system of coast defenses now or ever likely to be adopted. In case of war, all material of value would of necessity have to be removed.

The first cost of this site would be upwards of $311,000, as appears from letter of its principal owner, Mr. A. W. Benson, under date of September 7, 1888. The cost of a suitable wharf for landing heavy guns and of a tram-way from it to the firing point would probably not exceed $75,000.

Mr. Benson has more recently declined to offer this site for sale to the Government (See letter of his representative, Mr. McCue, dated November 2, 1888), but while the Board, taking all things into consideration, does not consider this site to be equal to that at Sandy Hook as a proving ground, it is so much impressed with its manifest advantages as to recommend that, if the necessity should ever occur, renewed efforts be made to secure it.

RICHLAND.

This tract of land is situated in southern New Jersey, about 40 miles from Philadelphia, and, at its northerly end, 2½ miles distant from Richland, a station on the West Jersey and Atlantic Railroad connecting Philadelphia and Atlantic City, N. J. The tract which extends due north and south in the direction of its length is 10 miles long and 2 miles wide, less a triangle off the northeast corner as shown on the map herewith, inclosure H^6, and contains about 12,375 acres of land. The surface consists of a gravelly loam covered by a thick growth of scrub-oak, cedar, and pine varying in height from 6 to 30 feet. The land is generally level, sufficiently so for the purposes of a proving ground, and the soil for the most part is firm and dry, although sandy in places, but is interspersed with a number of small streams, in the vicinity of all of which there is marshy land. One of these marshes, about 2½ miles from the northerly end of the tract and which would cover from one-half to three-fourths of a mile of the probable firing line to be selected, appears to offer the only serious inconvenience to the establishing of a good and sufficient firing line from 8½ to 9 miles in length, depending upon the extent of ground reserved for building purposes, etc. The marsh referred to can, it is believed, be drained sufficiently well or crossed by causeways to render it not a serious obstacle.

There are several wooden dwellings now upon the land with small clearings, to be included in the purchase, which would be of little or no value to the Government.

In view of the sparseness of the habitations now adjoining this land and the character of the improvements, the Board is of the opinion that the site is sufficiently remote from settlements to avoid probable danger of accident or damage to private property. In this, however, the Board omits any reference to consequential damages which might arise, due to a depreciation of value for future improvements, on private lands adjoining. The most valuable adjoining land, at present, is that on the north, which is stated, inclosure H^1, to have been recently sold for $20 per acre.

At present, the nearest towns are Richland, 2½ miles, and Vineland, 7 miles distant from the boundaries of the tract.

It is assumed that the northerly end of this tract would be the proper location for a firing point, and that connection by rail with points of supply, etc., would be made at Richland. The terminal points of the railroad through this valley are Camden and Atlantic City, N. J., both on tide-water; but, owing to the poor harbor entrance and difficult navigation to reach Atlantic City from the ocean, the nearest accessible point for water communication with the site is at Camden, on the Delaware River, 39 miles distant. The West Jersey and Atlantic forms a part of the Pennsylvania Railroad system, and this company has stated to the Board, through one of its agents, that it will undertake to transport from Jersey City or from Camden to Richland a gun weighing 120 tons. A continuous line of railroad without transshipment is afforded from Watervliet Arsenal to Richland, via Albany, Jersey City, and Camden, over the Delaware and Hudson, the West Shore, and Pennslyvania Railroad system. Water communication between Watervliet Arsenal and Camden, sufficient to transport the heaviest guns, is afforded by the Hudson River and the Delaware and Raritan Canal into the Delaware River at Bordentown, thence to Camden. In this connection attention is invited to letter, inclosure H[4], from the superintendent of the canal company. The facilities for rail communication to Richland are sufficient, but it is entirely destitute of direct water communication; the latter is conveniently accessible only at Camden. For shipments of heavy guns it would be necessary for the Government to provide special railroad trucks. Richland is distant by either rail or water (from Camden) about 280 miles from Watervliet Arsenal.

As stated in inclosures herewith Hs 2, 3, and 5, Mr. C. G. Patterson offers to convey this tract of land to the United States, free of all incumbrances in the shape of roads, dwellings, etc., and to include a railway connection between the northerly end of the tract and the West Jersey and Atlantic Railway at Richland, for the sum of $225,000. In this it is understood that the estimated cost of the railway connection is $25,000, which leaves the value of the land $16.16 per acre.

At the time of the visit of the Board the new road, 4 miles in length and the clearing at the northerly end of the tract, mentioned by Mr. Patterson, were nearly completed.

In regard to the selection of this site for a proving ground the Board is of the opinion that if an exclusively land range is to be selected this site is suitable; but the Board would further state its opinion that it is very desirable, if not essential, that a proving ground should afford facilities for tests of various war-like appliances in or over deep water, and in this view of the case the Board does not recommend the Richland site for selection as a proving ground.

SANDY HOOK.

In the preparation of the following description of Sandy Hook, free use has been made of the preliminary report of the Board of Officers constituted by Special Orders No. 122, current series, Adjutant-General's Office. See inclosure B[2].

The accompanying map of Sandy Hook, inclosure B[3], shows the situation and extent of the Government reservation, and the location of the buildings, etc. It is distant about 20 miles from New York City over a course navigable for the largest vessels and lying entirely within the line of outer defenses for New York harbor. The present dock facilities at the Government landing are inadequate for the proper and secure handling of the heavier guns which, in the near future, will probably be comprised in our sea-coast armament. The dock is, however, easily repairable, and at an expense of from $10,000 to $15,000 it could be made secure and accessible for discharging or loading vessels capable of transporting all the material required for sea-coast armament to any part of the coasts of the United States. Deep and still water providing safe anchorage for vessels is found close at hand.

The railroad connections to this point are by means of the Southern Railroad of New Jersey from Long Branch, terminating at the company's wharf on Sandy Hook. From Long Branch easy connections can be made by means of the Reading and Pennsylvania systems to any point in the United States. For instance, the route from Watervliet Arsenal to this point would be via Delaware and Hudson Canal Company's Railroad and the West Shore Railroad to the vicinity of Jersey City, thence by either of the systems mentioned to Long Branch and Sandy Hook, the total distance being about 184 miles. It is considered by the Board that the utilization of these railroad facilities is absolutely necessary to the full development of the advantages of Sandy Hook as a proving ground. This could be easily effected by building on the reservation a branch connecting the road leading from Long Branch and the firing point. This branch would be about 1½ miles in length and could be constructed at an estimated cost of $10,000 per mile. This branch constructed and the wharf repaired as stated above, together with some dredging to cost about $300, the transportation facilities to Sandy Hook would be ample, and superior to those at any point visited by the Board.

The length of the reservation is 5 miles nearly; the width of the northern portions averages somewhat over one-half mile, increasing to about 1 mile near the middle length. At the south the land contracts to a narrow reach of sand, averaging about one hundred yards in width over a length of three-fourths of a mile. This configuration of the land lends itself in a remarkable degree to contribute to the necessary isolation of the locality. The land is nearly level, and naturally well graded for general purposes, and ample and suitable space is at hand for the construction of buildings or other works required. The range is located near the ocean beach, and the line of fire extends southward; there is a safe and suitable range over land for low angle-firing up to about 4,500 yards, and for mortar or high-angle firing up to about 5,000 yards, and if Life-Saving Station, No. 2 was removed back to the vicinity of the railroad tract, this range would extend to about 6,600 yards. Unlimited facilities exist for water-ranges of guns, and for the test of shell to act under water, or for any other purpose for which a water range can be utilized. Plane-tables have been established on the fort wall and at the Navesink Light, giving a base-line about 5 miles in length, which is ample for the determination of any sea-range that may be required, with a degree of accuracy closely approximating that to be obtained by measurements over land.

Various buildings, and other important special appliances, are now available at this place. These consist of a machine-shop for repairs, an office-building with instruments and appliances for taking velocities, etc., various platforms for guns, including two of concrete, targets, a building for officers' quarters, quarters for foreman and enlisted men, and a telegraph office.

Inasmuch as the military reservation at Sandy Hook constitutes an essential feature in the system of defenses needed for the protection of the most important harbor in the United States and its largest and wealthiest community, the forts and batteries to be erected there, and the occupancy of the land by military forces in case of foreign attack will always insure that a proving ground at Sandy Hook will remain in proper protective relations to the system of coast and frontier defenses.

In complying with the instructions to the Board to state whether such site or sites as it may visit are preferable or otherwise to the present proving ground at Sandy Hook, the Board is obviously limited to a comparison with the Montauk and Richland sites.

Recognizing that deficiencies do exist in each of the three sites named, the Board is constrained to consider their respective advantages and disadvantages and to award them an order of merit based upon a consideration of all the points which have been hereinbefore stated more or less in detail, and which in the opinion of the Board should have most weight in determining the selection of a site for a proving ground. After careful consideration the Board concludes that the three sites named possess the following order of merit, viz: first, Sandy Hook; second, Montauk Point; third, Richland.

Montauk Point has the advantage of Sandy Hook, but more especially of Richland, in that it combines an adequate land range with an unlimited sea range, and also that there are large ponds of deep still water which might be used with advantage in tests of shells made to burst in water. In common with Sandy Hook, and with advantage over Sandy Hook, it possesses a marked advantage over Richland in the isolation which the proving ground would have and the freedom from encroachments from outside parties.

The disadvantages of Montauk as compared with Sandy Hook are its remoteness from points of supply by water transportation, and the lack of rail communication; the probable first cost of the land, the cost of providing proper wharfage, and for the transport of guns from the water to the firing point; the unevenness of the ground, rendering more or less grading necessary to locate the targets at short ranges, and that it would not be in proper protective relations to the system of coast defense. In healthfulness and comfort to the personnel of the working force on the range Montauk would be superior to either Sandy Hook or Richland, the latter especially, where the mosquitoes in summer may prove not only an annoyance but a serious hindrance to work. Montauk is almost free from mosquitoes.

Richland is superior to either of the other sites in that it affords facilities for the best range over land; but comparing it with Sandy Hook on this point, the advantage exists for comparatively long-range firing, or perhaps for less than 20 per cent. of all the firing to be done. It will be noted that the land range at Sandy Hook is well adapted to all proof firing, to all tests of armor and tests of projectiles against armor, to nearly all the firing tests to which field and siege arms will be subjected, and, assuming that proper butts are erected behind the targets, to tests of accuracy for all low-angle firing; whilst for long-range firing and for accuracy of mortars at greater ranges than 5,000 or 6,600 yards, the water range can be utilized. The Board considers that the disadvantage of the water range at Sandy Hook, as needed for long-range firing, lies more particularly in the necessity of waiting for calm weather and in the interruptions occasioned by passing vessels, but these are disadvantages

inherent in a water range over navigable waters, and can be overcome. In calm weather, it is believed, the range firing to sea can be done with sufficient accuracy, and advantage can be taken of such weather to make these firings.

The absence of any water range at Richland is a serious disadvantage, primarily, because there could be no tests of shell bursting in water and no tests of high explosive shell or aërial dynamite torpedoes upon objects on water; and it is believed that this very important and recent branch of defensive appliances can not be properly developed except over a water range.

Sandy Hook possesses a marked advantage over Richland in the complete facilities which can be afforded for transportation both by rail and water. Its location for a proving ground, as a convenient center for receipt of guns, etc., from points of supply and their distribution to points of final destination can not probably be excelled. It is, moreover, at present the only military reservation in the vicinity of New York Harbor which can be used for extensive firing tests, and, considering the relative magnitude of the defenses required for New York Harbor and vicinity, it will be most convenient to retain the proving ground at Sandy Hook for the conduct of experiments required in connection with the erection of forts and batteries in close proximity to the ground where they are most needed.

Sandy Hook possesses the capacity for the conduct of experiments and tests considered by the Board absolutely necessary to the full development of the resources of a perfect proving ground, and from which the Department would be excluded were it confined to an exclusively land range; moreover, there is nothing which could be done on such a range which could not for practical purposes, although under certain disadvantages, be accomplished at Sandy Hook. Assuming, therefore, that the suggested improvements have been made, the Board has to report that none of the sites visited by it is preferable to the proving ground now in possession of the Government at Sandy Hook.

JOHN E. GREER,
Captain, Ordnance Department, U. S. Army.
FRANK HEATH,
Captain, Ordnance Department, U. S. Army.
R. BIRNIE, Jr.,
Captain, Ordnance Department, U. S. Army.

Stoddard, Glens Falls, N. Y.

Copyright.

ACADEMIC BUILDING—DEMOLISHED, JULY, 1891.

52D CONGRESS, 1st Session. | SENATE. | MIS. DOC. No. 19.

IN THE SENATE OF THE UNITED STATES.

REPORT

OF THE

BOARD OF VISITORS

TO THE

WEST POINT MILITARY ACADEMY.

DECEMBER 14, 1891.—Referred to the Committee on Military Affairs and ordered to be printed.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1891.

WASHINGTON, *December 14, 1891.*

SIR: The undersigned members of the Board of Visitors to the West Point Military Academy, appointed on the part of the Senate of the United States by the Vice-President to attend the annual examinations of the Military Academy for the year 1891, in conjunction with the other members of the Board appointed by the Speaker of the House of Representatives and the President of the United States, having performed the duties devolving upon them by virtue of their appointment, herewith submit their report, adopting the report made by the full Board of Visitors in which we join as members.

CHARLES F. MANDERSON.
JAMES L. PUGH.

Hon. LEVI P. MORTON,
Vice-President and President of the Senate.

BOARD OF VISITORS.

JUNE, 1891.

APPOINTED BY THE PRESIDENT OF THE UNITED STATES.

1. Rev. FRANK A. O'BRIEN.....KALAMAZOO, MICHIGAN.
2. Colonel JAMES T. MURFEE.....MARION, ALABAMA.
3. Hon. JAMES A. WAYMIRE.....SAN FRANCISCO, CALIFORNIA.
4. Major JOHN M. CARSON, (*Secretary*).....WASHINGTON, DIST. OF COL.
5. Mr. DAVID W. PAYNE.....ELMIRA, NEW YORK.
6. General THEODORE S. PECK.....BURLINGTON, VERMONT.
7. Hon. ROBERT O. FULLER.....CAMBRIDGE, MASSACHUSETTS.

APPOINTED BY THE PRESIDENT OF THE SENATE.

8. Hon. CHAS. F. MANDERSON, (*President*).....OMAHA, NEBRASKA.
9. Hon. JAMES L. PUGH.....EUFAULA, ALABAMA.

APPOINTED BY THE SPEAKER OF THE HOUSE OF REPRESENTATIVES.

10. Hon. JULIUS C. BURROWS.....KALAMAZOO, MICHIGAN.
11. Hon. JOSEPH A. SCRANTON.....SCRANTON, PENNSYLVANIA.
12. Hon. SAMUEL W. T. LANHAM, (*Vice-President*) WEATHERFORD, TEXAS.

REPORT

OF THE

BOARD OF VISITORS

TO THE

UNITED STATES MILITARY ACADEMY,

FOR THE YEAR 1891.

To the Secretary of War, the President of the Senate, and the Speaker of the House of Representatives:

The Board of Visitors appointed to attend the annual examination of the United States Military Academy for the year 1891 assembled at West Point, in the rooms provided for that purpose, on the 1st of June. The authority for appointing this Board, the purpose for which it is appointed, and the duties devolved upon it, are found in the two following sections of the Revised Statutes of the United States:

SEC. 1327. There shall be appointed every year, in the following manner, a Board of Visitors to attend the annual examination of the Academy. Seven persons shall be appointed by the President, and two Senators and three members of the House of Representatives shall be designated as visitors by the Vice-President or the President *pro tempore* of the Senate and the Speaker of the House of Representatives, respectively, at the session of Congress next preceding such examination.

SEC. 1328. It shall be the duty of the Board of Visitors to inquire into the actual state of the discipline, instruction, police administration, fiscal affairs, and other concerns of the Academy. The visitors appointed by the President shall report thereon to the Secretary of War, for the information of Congress, at the commencement of the session next succeeding such examination, and the Senators and Representatives designated as visitors shall report to Congress, within twenty days after the meeting of the session next succeeding the time of their appointment, their action as such visitors, with their views and recommendations concerning the Academy.

In accordance with these provisions of law the following named gentlemen were appointed to constitute the Board of Visitors for the year 1891, and requested to assemble at the Military Academy on the 1st day of June:

APPOINTED BY THE PRESIDENT OF THE UNITED STATES.

Rev. FRANK A. O'BRIEN ..... Kalamazoo, Mich.
Col. J. T. MURFEE ..... Marion, Ala.
Hon. JAMES A. WAYMIRE ..... San Francisco, Cal.

Maj. JOHN M. CARSON.....Washington, D. C.
Mr. DAVID W. PAYNE.....Elmira, N. Y.
Gen. THEODORE S. PECK.....Burlington, Vt.
Hon. ROBERT O. FULLER.....Cambridge, Mass.

APPOINTED BY THE PRESIDENT OF THE SENATE.

Hon. CHAS. F. MANDERSON.....Omaha, Nebr.
Hon. JAMES L. PUGH.....Eufaula, Ala.

APPOINTED BY THE SPEAKER OF THE HOUSE OF REPRESENTATIVES.

Hon. JULIUS C. BURROWS.....Kalamazoo, Mich.
Hon. JOSEPH A. SCRANTON.....Scranton, Pa.
Hon. SAMUEL W. T. LANHAM.....Weatherford, Tex.

ORGANIZATION OF THE BOARD.

An organization was perfected by the unanimous selection of Hon. Charles F. Manderson as president; Hon. Samuel W. T. Lanham as vice-president; and Maj. John M. Carson as secretary.

Upon a call of the roll it was ascertained that all the members of the Board were present except Mr. Waymire, from whom a telegram was read explaining that he had been unavoidably detained on the road and would reach West Point the following day.

It was ordered that the regular meetings of the Board should be held daily at 3 o'clock p. m.

The president of the Board was authorized to appoint the usual committees for the examination of the various departments of the Academy.

The secretary was directed to notify Col. John M. Wilson, Superintendent of the Military Academy, that a quorum of the Board of Visitors was present, that the Board had been duly organized, and was prepared to proceed with the business for which it had been appointed. In accordance with this direction the secretary addressed the following letter to Colonel Wilson:

ROOMS OF THE BOARD OF VISITORS,
West Point, N. Y., June 1, 1891.

SIR: I have the honor to inform you that the Board of Visitors to the U. S. Military Academy for the year 1891, assembled this day at the place appointed for that purpose, and organized by the selection of Hon. Charles F. Manderson as president, Hon. Samuel W. T. Lanham as vice-president, and Maj. John M. Carson as secretary.

I have also the honor to inform you, by direction of the Board, that any communication you may desire to make in reference to the affairs connected with the Military Academy will be cheerfully received and be given careful consideration.

Very respectfully, your obedient servant,

JOHN M. CARSON,
Secretary.

Col. JOHN M. WILSON,
Superintendent U. S. Military Academy.

After a short recess the Board reassembled, when the president laid before the Board the following communication from Colonel Wilson, Superintendent of the Academy:

HEADQUARTERS U. S. MILITARY ACADEMY,
West Point, N. Y., June 1, 1891.

SIR: I have the honor to acknowledge the receipt of your communication of this date notifying me of the organization of the Board of Visitors.

I shall be happy to afford the Board every facility for a thorough inspection of the workings of all the departments of the Academy, administrative as well as those of instruction, and in general to do everything possible to assist the Board in its labors.

A programme of the examination has already been furnished each member. Notice will be given from day to day of such military exercises as are ordered for the Board of Visitors.

First Lieuts. Frank L. Dodds, Ninth Infantry; Joseph E. Kuhn, Corps of Engineers; and Daniel L. Tate, Third Cavalry, have been detailed to attend upon the Board of Visitors during their stay at the Academy.

I also take occasion to say that I hope the Board will communicate with me freely, both personally and officially, upon any subject connected with the Military Academy which may be of interest to its members in connection with their official visit to West Point.

In conclusion permit me to say that I desire to call officially upon the Board of Visitors at the hotel at 4:20 o'clock p. m. to-day, with the members of the Academic Board and my military staff, for the purpose of paying our respects to the Board of Visitors and to conduct them to a review of the corps of cadets given in their honor.

At the close of the review it will give me pleasure to receive the members of the Board, their families, and friends at my quarters to meet the officers and ladies of the post.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Colonel of Engineers, Superintendent.

Hon. CHAS. F. MANDERSON,
President Board of Visitors, West Point, N. Y.

A copy of Orders No. 74, dated West Point, N. Y., May 14, 1891, was also laid before the Board and copies furnished each member. These orders announced the programme for the examinations of the various sections and classes and concluded with the following order of military exercises for the period between the 1st and 12th of June:

VI. The following military exercises will take place during the examination:

Infantry	Review	June 1
	School of the battalion	June 4
	School of the battalion (skirmish drill)	June 9
Artillery	Heavy artillery drill (sea-coast guns)	June 2
	School of the battery (field artillery)	June 6
	Heavy artillery drill (siege mortars)	June 9
Cavalry	School of the soldier, mounted	June 3
	School of the company, mounted	June 5
Practical military engineering	Military bridge construction (pontoon bridge)	June 8
	Military signaling	June 10
Small arms	Use of the sword and bayonet, military gymnastics	June 11

This order of exercises may be changed on account of the weather or for other causes.

VII. The members of the First Class will be graduated June 12, 1891.

By order of Colonel Wilson.

J. M. CARSON, JR.,
Second Lieutenant Fifth Cavalry, Adjutant.

The Superintendent, accompanied by his military staff and the members of the Academic Board, called upon the Board of Visitors at their rooms, and after an interchange of courtesies escorted them to the parade ground to witness the review arranged in their honor. Hon. Levi P. Morton, Vice President of the United States, having arrived at West Point a few hours prior to the time fixed for the review, upon invitation of the Board of Visitors participated in the ceremonies.

At the second session Hon. James A. Waymire appeared and assumed his duties as a member of the Board.

The President announced the following as the committees:

Appointments and Examinations.—Messrs. Pugh, O'Brien, and Scranton.

Discipline and Instruction.—Messrs. Murfee, O'Brien, and Peck.

Armament and Equipment.—Messrs. Peck, Manderson, and Waymire.

Buildings and Grounds.—Messrs. Payne, Lanham, and Fuller.

Supplies and Expenditures for Cadets.—Messrs. Burrows, Lanham, and Carson.

Fiscal Affairs.—Messrs. Scranton, Fuller, and Payne.

The committees proceeded at once to inquire into the matters assigned them respectively, and pursued their inquiries with commendable diligence. The results of these several inquests will be found in the reports made to and approved by the Board after full discussion.

PLAN OF PROCEDURE BY THE BOARD.

The plan upon which the Board proceeded to gain information about the various departments of the Academy was adopted for the purpose of ascertaining facts free from any influence of those connected with the administration of its affairs. It is proper to state in this connection that neither the Superintendent nor his assistants, at any time, except when so requested, offered suggestions or performed any act intended to influence the judgment of the Board or its members individually. Every opportunity was offered and every facility extended for full investigation of each department of the Academy, and every officer when called upon for information promptly responded. The committees daily prosecuted inquiries into the various departments, and at the regular meetings of the Board questions deemed important were presented for general discussion. By this course of procedure every member of the Board was made acquainted with the methods of each department of the Academy through the investigations of the committees, the necessity for changes when changes were recommended, and was thus prepared to act intelligently upon all matters presented by the committees. These regular meetings were found to be so interesting and instructive that during the fifteen days the Board was at the Academy not one meeting was dispensed with, and, with two or three exceptions, each meeting was attended by all the members. Several of them were at-

tended by the Superintendent and other officers of the Academy, from whom the Board desired information upon questions under consideration and whose attendance had been requested.

The reports of all the committees were presented during the days the Board was at West Point, their contents fully considered, and their recommendations discussed and acted upon. The final adjournment of the Board occurred on the morning of June 12. During the sessions a number of subjects were discussed and resolutions adopted which have no place in the reports of the committees. These matters are presented in the general report.

The Superintendent requested the Board to designate one of the members to deliver an address to the graduating class on the day of graduation, and in accordance with this request Hon. Julius C. Burrows was chosen. Rev. Frank A. O'Brien was also designated by the Board to deliver a short address upon that occasion.

The secretary was selected to write the general report and authorized, in the name of the Board, to call upon the War Department, the Superintendent of the Academy, and other parties from whom information deemed necessary in the preparation of the general report might be obtained.

APPOINTMENTS AND EXAMINATIONS.

Committee on Appointments and Examinations.—Messrs. JAMES L. PUGH, FRANK A. O'BRIEN, and JOSEPH A. SCRANTON.

SHOULD THE CORPS OF CADETS BE INCREASED?

The Board devoted considerable time to the question whether the strength of the corps of cadets as now established by law should be increased. This is not a new question. It has been discussed in Congress, in the public press, and in the reports of former Boards of Visitors. Opinion has been divided touching the general proposition, and varied as to the extent to which an increase should be made and the methods for its accomplishment. On the one hand many persons, influenced by the pride and enthusiasm incidental to a visit to West Point during the annual examinations and exhibitions, coincide with the opinion expressed by Gen. U. S. Grant upon the occasion of one of his visits to the Academy, and after he had visited many foreign countries, that there should be one thousand cadets at West Point. On the other hand, less sentimental but more practical persons believe that the measure of increase should not exceed the capacity of the present establishment. General Grant's expression that one thousand cadets should be receiving instruction at West Point was doubtless intended to express his estimate of the value of the Academy, and the excellence of the institution as a school for military instruction and training, and not a deliberate recommendation to increase the strength of the corps of cadets to the large number stated in the expression so often quoted.

To maintain one thousand cadets at West Point may not be impracticable but would be impolitic for several reasons, not the least of which is that of expense. The work performed at the Military Academy is admittedly of the highest importance and value to the nation. It teaches young men the art of war, and gives its graduates training which qualifies them to serve the country in a state of war to the greatest advantage. The present capacity of West Point is equal to supplying the annual casualties of the United States Army, but even should the number of graduates exceed this requirement the country would be largely benefited by having in civil life, in every State of the Union, men who have passed successfully through the Military Academy. These men would naturally become identified with the National Guard, and, should the emergency arise, would become efficient instructors and competent

Copyright. Stoddard, Glens Falls, N. Y.

CADET BARRACKS, FROM THE NORTH.

commanders of newly formed regiments and brigades. The importance and value of having among the body of the people men of military education and training is illustrated by the fact that during our civil war many of the most successful and distinguished officers in both armies were men who graduated at West Point, but who were engaged in civil life upon the breaking out of hostilities.

If we are to consider the Academy merely as the means of furnishing the necessary material for supplying the annual casualties of the present Army in time of peace, no change in existing laws governing this question is required. But the Military Academy has been established and brought to its present high standard of excellence and efficiency by years of labor and experience and large expenditures of money. It has capacity for training and educating at one time at least 400 students without material increase in the annual cost of its maintenance, and the Board believes it would be good policy to obtain for the Army and the country the full fruition of the institution by increasing the strength of the Corps of Cadets so that it may be at all times, after providing for casualties, nearly equal to the membership of the House of Representatives.

STRENGTH OF THE CADET CORPS.

The strength of the Corps of Cadets is fixed by law at "one from each Congressional District, one from each Territory, one from the District of Columbia, and ten from the United States at large." Under the existing Congressional apportionment the maximum strength of the corps is 347. Under the apportionment act passed at the last session of Congress, and under the operations of which the Fifty-third Congress will be chosen, this number will be increased to 371. The intent and purpose of the law creating the Academy and of all laws amendatory thereof was clearly to educate at the institution a number of young men equal to the membership of the House of Representatives plus the number which the President is authorized to appoint. If this purpose could be carried out and the corps maintained at the legal maximum, the number of young men who should annually graduate would be 87, of whom 40 or 50 would be needed to supply vacancies in the Army. It is perhaps impossible that this number could be actually graduated, because it is unreasonable to expect that there will not be cases of deficiency; but that the number of graduates should be greater than it now is will not be denied by fair-minded men who will give the subject even slight investigation.

The strength of the corps at this time, exclusive of the two young men from Switzerland and Nicaragua who are receiving instruction under special act of Congress, is 284, or nearly 23 per cent. below the strength fixed by law. This large percentage of deficiency is mainly due to the selection of poor material by members of Congress, aided, in many cases, by an entire failure to select. Upon the graduation of the class

of this year there were 155 vacancies to be filled. For these, 138 principals were appointed, leaving 17 districts from which no appointments were made. Of the principals appointed 9 failed to report at the Academy, thus reducing the number to 129, of whom only 90 succeeded in passing the preliminary examinations. At the same time 64 alternates were appointed, of whom only 30 reported, and of these but 7 were admitted, so that, instead of a class of 155, we have only a class of 97 to start upon the 4-years' course of study and training. This delinquency is equivalent to a waste of 37 per cent. of the power and energy of the institution, because the same forces used in the training of 97 cadets would train 155.

AN INCREASE RECOMMENDED.

Much attention was given this subject by the Board. The committee having the matter in charge made careful inquiry into it, discussing it with members of the Academic Board and the more experienced military officers on duty at the Academy, and it was also discussed with the Board at two meetings, set apart for that purpose, by Colonel Wilson and Professor Michie. As the result of this inquiry the Board unanimously adopted the report of the Committee on Appointments and Examinations, and agreed to recommend the passage of an act fixing the strength of the Corps of Cadets at a maximum of 469. In the selection of candidates for admission to the Academy, the Board recommends that in addition to the present allotment of 1 cadet to each Representative and Delegate in Congress, 2 cadets be alloted to each State at large, to be nominated by the Senators respectively, and that the President be authorized to nominate from the country at large 20. The practice prior to the passage of the act of June 11, 1878, was for the President to nominate 10 cadets for each year. The act referred to limited the appointments by the President to 10 for the academic term of four years. Should this increase be authorized, and in the manner proposed, there would be set apart for the House of Representatives 361 cadets, the number authorized under the new apportionment act, the Senate 88, and the President 20, thus making the total number 469. It is believed by the Board, based upon an examination of failures among candidates and casualties among cadets, that the proposed increase from 371 to 469 would be the means of maintaining the strength of the Corps of Cadets at about the number originally intended, namely, "one from each Congressional District, one from each Territory, one from the District of Columbia, and ten from the United States at large." Under the apportionment act of 1891 the House will consist of 356 Representatives and 4 Delegates from the Territories, which gives, with one from the District of Columbia, 361 as the number of cadets at the Academy exclusive of the 10 which the President is authorized to appoint.

SELECTION AND EXAMINATION OF CANDIDATES.

The present method of selecting candidates, and the time and manner of conducting their preliminary examination, were also made the occasion of special inquiry and discussion by the Board. We believe that an immediate change in both these particulars should be made. In the matter of selecting candidates the fact that so many of those nominated by members of the House of Representatives fail to pass the preliminary examinations, and the additional fact that many Representatives fail to nominate at all, or hold vacancies open for a year or more in order to nominate a particular person, show that some action should be taken to correct this abuse. The report of the committee on Appointments and Examinations discusses this question, and the special attention of the proper authority is earnestly directed to it. Previous Boards of Visitors have discussed this general question and all have recommended such action as would compel Representatives to make nominations of cadets at the proper time, and that such regulations should be made as will insure a larger number of admissions to the Academy. The Board of Visitors for 1887, of which Mr. George W. Childs, of Philadelphia, was president, in discussing the method of selecting candidates, directed the attention of the military authorities and the country to the prevailing abuse with a force and directness that should have commanded prompt action on the part of the President and the War Department. This is a matter within the province of the President and Secretary of War to regulate and correct. Members of Congress should be required, at the proper time, to nominate candidates to fill vacancies at the Academy, and failing to do this, appointments should be promptly made by the President from the list of eligible candidates filed at the War Department. The belief is general that members of the House of Representatives possess the right to appoint candidates for admission to the Military Academy. That such right does not exist under authority of the statutes is shown by the report of the Board of Visitors for 1887, which says on this subject:

> The opinion has obtained that members of the House of Representatives have the *right* to appoint candidates for admission to the U. S. Military Academy. This is an error. The *courtesy* has been extended by the President to Representatives of permitting them to nominate candidates, but they have no more right to make an appointment than they have to appoint a postmaster or a collector of customs. The law authorizing and regulating appointments to the Military Academy is found in chapter 4 of the Revised Statutes, and the attention of members of the House of Representatives is specially invited to it. It provides:
>
> "SEC. 1315. The corps of cadets shall consist of one from each Congressional district, one from each Territory, one from the District of Columbia, and ten from the United States at large. *They shall be appointed by the President*, and shall, with the exception of the ten cadets appointed at large, be actual residents of the Congressional or Territorial districts, or of the District of Columbia, respectively, from which they purport to be appointed.
>
> "SEC. 1317. Cadets *shall be appointed one year in advance of the time of their admission to the Academy*, except in cases when, by means of death or other cause, a vacancy occurs which can not be provided for by such an appointment in advance." * * *

There can be no difference of opinion as to the construction of the law above quoted. The right to appoint is not only lodged in the President alone, but the obligation to appoint is imposed. The recommendation of the Representative is in no sense binding on the President, and gives the candidate so recommended by him no legal right to priority in the consideration of the President. The practice of appointing the person recommended by the Representative of the district in which a vacancy exists has been found, as a rule, to work satisfactorily; but the matter of appointment to the Military Academy has been so completely assumed as a right by the Representatives that it has come to be considered as a personal prerogative, to be given and withheld at pleasure. The result of this abuse—for it is an abuse—of the privilege extended by the President has been, and continues to be, detrimental to the public interests and expensive to the public Treasury. The Board would not be understood as recommending a withdrawal of the privilege of nominating candidates so long enjoyed by Representatives, and direct public attention to the matter simply to correct a popular error and in the hope that it will result in the adoption of a regulation by the President that will *require* Representatives to promptly recommend candidates for appointment to the Academy with the alternative of a selection being made directly by the President. The importance and necessity for the immediate adoption of such a regulation is shown by the fact that a large number of districts are constantly unrepresented at the Academy, by reason of the indifference and neglect of members of the House of Representatives, and sometimes of the deliberate design of a Representative to keep the place vacant for a year or two in order to accomplish the appointment of a particular candidate in furtherance of his own political preferment.

DERELICTION IN NAMING CANDIDATES.

In this connection it may be urged that the custom of permitting Representatives to absolutely determine the disposition of appointments of cadets to the Military Academy has been of such long standing as to have all the binding force of law. If this power was exercised by the Representatives in the direction of the public interest and in accordance with the spirit of the law, the plea of long continued custom might be treated with respect. But when exercised at the whim of the Representative, or to advance his individual interests, the authority which is alone vested in the President should be resumed by him and exercised to promote and maintain those interests which have been persistently neglected by the Representative. The Board earnestly directs the attention of the President and Secretary of War to this matter. We suggest that notification be given members of Congress that hereafter nominations for appointment to the Military Academy must be made for vacancies that are to occur the year next following on or before January 1, and that in all cases when nominations are not so made the President will exercise his authority to appoint.

The annual examinations take place in June. The law requires that "cadets shall be appointed one year in advance of the time of their admission to the Academy," except in cases where the vacancy is the result of casualty other than graduation. Public notice could be given
e newspapers of the prospective vacancies, and young men
tricts in which vacancies are to occur possessing the

prescribed qualifications invited to forward to the War Department applications and recommendations. In this way the President would be enabled to select a young man for appointment in every district in which the Representative was derelict. The fact that the President proposed to exercise his authority in the premises would in itself be sufficient to correct the abuse complained of.

PRESENT METHOD OF EXAMINATION DEFECTIVE.

Judged by its results the present method of examination of candidates for admission to the Academy is defective, and this opinion is sustained by members of the Academic Board and others who have inquired into it. The large percentage of failures may primarily be chargable to a lack of proper training of candidates, but whatever the cause it should be remedied in order that the largest possible amount of raw material might be secured for the successful manipulation of the institution. That only 50 per cent. of all those admitted to the Academy has been graduated for many years may be regarded as a reflection upon the preparatory schools and academies of the country, but can not truthfully be said to be a correct estimate of the real character of their worth and efficiency. The Board believes that this great deficiency is attributable to the lack of proper care in selecting candidates and not to an absence of efficiency in the public and private schools of the country. Candidates are frequently sent to West Point whose lack of qualification would have been apparent before leaving their homes had they been subjected to examination. In many cases the failure of candidates is due to the absence of any training rather than to the insufficiency or inefficiency of any particular school or system. This would be remedied by holding the examinations at stated times in the several States, in the manner recommended by Colonel Wilson when conferring with the Board and outlined in the paper prepared by him and made part of this report.

NEW METHOD OF APPOINTMENT RECOMMENDED.

The Board approves in the main the plan of examination recommended by Colonel Wilson and commends it to the attention of the honorable Secretary of War. If adopted, with some change in details, it would undoubtedly be attended with good results. We recommend:

(1) That hereafter Representatives be required to nominate candidates not later than January 1, and in all cases of failure to nominate that the President designate young men for all districts that may be delinquent on that date.

(2) That examinations, physical and mental, be held at certain convenient points, to be designated by the Secretary of War not later than March 10, and that these examinations be conducted in the same manner as examinations are now conducted at the Military Academy, and under the direction and supervision of the Academic Board, the examinations to be held throughout the county upon the same days.

(3) That the examination questions be prepared by the Academic Board, each set of questions to be inclosed and sealed and sent to the Adjutant-General of the Army for transmission to the several officers appointed to conduct the examinations.

(4) That officers of the Army, not to exceed two at each point, be detailed to be present at the examinations, to whom the examination questions shall be sent by the Adjutant-General in the exact condition in which they were received by him from the Military Academy, and by whom alone the seals on the respective packages shall be broken on the day and in the place appointed for the examinations, and in the presence of the candidates there assembled, to whom the questions shall be delivered, one set of questions to each candidate in the order in which the subjects shall be taken up.

(5) That these officers be restricted to the conduct of the examination; that their duty be simply to be present at all times during the progress of the examinations, to see that each candidate performs his work without assistance, and to receive and forward the papers when completed to the Superintendent of the Military Academy under such regulations as may be prescribed by the Secretary of War.

(6) That when the papers are received at the Military Academy the Academic Board be required to proceed at once to examine and pass upon them, the results of this examination to be reported by the Superintendent as soon as practicable to the Adjutant-General of the Army.

(7) That Representatives be notified immediately by the Adjutant-General in case of failure of their candidates and requested to name other candidates not later than May 1, such candidates to be examined in the manner heretofore described, provided that can be done prior to June 20, otherwise the candidates to report to the Adjutant of the Military Academy not later than July 1 for examination at the Academy.

(8) That candidates who successfully pass the examinations held in their respective localities shall be admitted to the Academy without further examination.

(9) That no person who has failed to pass shall be again nominated for examination during the year for which such person failed.

In order to preclude favoritism in the examination of candidates and in passing upon their papers, the system now practiced at the Academy of assigning a number to each candidate, by which alone his papers are known to the Academic Board, should be followed. The numbers are assigned by the Adjutant of the Academy, and he is the only person who knows the names of candidates corresponding with the numbers. This information is held inviolate by the Adjutant until the final action of the Academic Board, when it becomes necessary to associate the names with the examination papers.

The plan of examinations recommended does not involve any change in scope or character as now conducted at the Military Academy, nor does it in any degree lessen the authority of the Academic Board

over them. It simply brings the place of examination nearer the home of candidates and saves them the expense of traveling to and from West Point in case of failure to pass. Many young men who might be designated for appointment as cadets are not able to assume the expense of a journey to West Point with the contingency of similar expense for the return trip in case of failure, and nominations have been frequently declined on this account. This is particularly true of boys living at points remote from West Point whose parents are unable to assume the expense of traveling. Under the proposed plan of conducting the preliminary examinations those who pass would know upon leaving their homes that they are to enter the Corps of Cadets and remain at the Academy at least for the period of six months, or until the regular semi-annual examination of the classes is made.

REPORT OF THE COMMITTEE.

Following is the report of the Committee on Appointments and Examinations, which was presented by Mr. Pugh and after considerable discussion adopted:

ROOMS OF THE BOARD OF VISITORS,
West Point, N. Y., June 8, 1891.

To the Board of Visitors:

The committee on Appointments and Examinations have had these subjects under consideration, and find that the ability of the Academy to carry out its objects and insure its usefulness is far greater than the number of cadets now allowed by law to enter the Academy. It is a great waste of the power and capacity now employed in the institution to allow it to be expended upon the present number of cadets. It is the opinion of the able and efficient Superintendent and faculty of the Academy that the present number of cadets can be increased to 500 without any considerable outlay in the expenditure of money, and without any considerable enlargement of the machinery and means of accommodation now belonging to the Academy. The committee are therefore unanimous in recommending that the number of cadets be at once increased to 500.

The most difficult problem for solution is where the power of selection and appointment shall reside and how it shall be exercised. The original and primary object of the creation of the institution was to qualify officers to command a standing army of the United States. History has demonstrated the eminent success and usefulness of the Academy, and the wisdom and patriotism that prompted its establishment and continued and enlarged its existence, have been fully vindicated by experience.

On account of the exclusive military character and objects of the Academy the power of appointment was vested in the beginning in the President; but that official soon learned by trial that it was impracticable and inexpedient for him to exercise the power efficiently, and for this reason he delegated the power of selection and nomination to the members of the lower house of Congress. It is manifest that the intention and policy of the Government have been and are now that the beneficiaries of the institution shall come from the people in each State and Territory without discrimination or partiality. And no doubt the purpose of the President in conferring upon members of the House the power of selection and nomination was to popularize the institution by extending and distributing its benefits generally and equally among the people of the States and Territories.

It is a fact that the candidates selected by the members of the House have not in very many cases been successful in standing the examinations and passing the tests

of qualification for admission into the Academy. As a rule it has been found that the maximum number of cadets allowed by law has not been kept up by at least one-third, thereby depriving the country of the benefits of its expenditure for one-third more cadets, and the cadets themselves of the invaluable instruction and training provided for them and wasted on account of their absence.

For reasons satisfactory to the members of the House it has been decided by them to improve the mode of selection and secure, if practicable, a better class of their constituents for nomination to the President, and the change made by the members is to delegate their delegated authority to a board of examiners, to call before them the several applicants and ascertain their fitness to stand the examination of the Academic Board at West Point and pass into the Academy. The competitive system thus established has proven to be a great improvement upon the old mode of direct appointment. It, however, continues to be a fact that the number of cadets is never up to the maximum by a large proportion, and this deficiency is an evil that should be corrected. Whether the trouble is in the power of selection or in the character of the examination there is much difference of opinion. The power of selection ought to be kept as near to the people of the several States as practicable, and so exercised as to secure an equal and fair distribution of the inestimable benefits of the institution among all the people.

In relation to the examination of the candidates for cadetships, the committee find that the practice of requiring the candidates to attend an examination at West Point to determine their physical and educational qualifications for admission into the Academy works great hardship to those who are found deficient. The plain remedy for this evil is the formulation of some plan for the examination in each State on the same day of all the candidates who may be designated by members of the House in their several districts as now authorized, and should the number of cadets be ncreased as suggested, then the selection of those to be examined to be made by the Members of the House and by the Senators from each State and the President of the United States, or otherwise, as Congress may determine. It would be an easy matter to discover the physical defects that disqualify, and an Army surgeon might be detailed to make the examination in each State for that purpose at the same time and place appointed for the educational examination.

It has been suggested by Colonel Wilson, the Superintendent, that the questions now required to be answered by the Academic Board at West Point could be printed and sent by an army officer to each State some two months before the time for entering the Academy, who would call each candidate from the several districts on the same day at the capital of the State, or other convenient point, where the written questions would be delivered to each candidate, and without conference with each other or other person each candidate, without separating from the army officer, would be required to write out his answers to each question, and the answers delivered to the army officer, who would seal them up and forward them to the Academic Board at West Point. These answers would be examined and the right of the candidates passed upon by the Board, and if found qualified the candidate to be notified and his appointment made at once without any further examination on his arrival at West Point. If no one is found qualified in any district from the list of those who have answered, another examination shall be ordered, and so on until the maximum number is appointed.

Respectfully submitted.

JAMES L. PUGH.
FRANK A. O'BRIEN.
JOSEPH A. SCRANTON.

VIEWS OF THE ACADEMIC BOARD.

In order to obtain the views of the Academic Board on the question of increasing the efficiency of the Academy, the secretary of the Board

of Visitors was instructed to request that body to prepare a paper on this subject. Accordingly the following letter was sent to Colonel Wilson:

ROOMS OF THE BOARD OF VISITORS,
West Point, N. Y., June 6, 1891.

SIR: The Board of Visitors have instructed me to inform you that they would be pleased to have from the Academic Board a paper expressing the views of that board, either individually or collectively, in relation to the methods of appointment and examination of cadets; whether any changes can be made in these methods which, in their judgment, would tend to increase the number of candidates and thereby tend to increase the number of graduates; and, also, as to the advisability, at this time, of increasing the maximum strength of the corps to an aggregate equal to the number of Senators, Representatives and Delegates in Congress, and ten appointments by the President of the United States. In connection with the question of increasing the present number of cadets, the Board would be pleased to have the opinion of the academic authorities as to whether the proposed increase would involve any additions to present facilities of the Academy for the imparting of instruction, and if so, what the character and extent of such additions would be.

Very respectfully, your obedient servant,

JOHN M. CARSON,
Secretary.

Col. JOHN M. WILSON,
Superintendent U. S. Military Academy.

To the foregoing letter the following reply was received by the secretary of the Board from Colonel Wilson:

HEADQUARTERS U. S. MILITARY ACADEMY,
West Point, N. Y., June 24, 1891.

MY DEAR SIR: I have the honor to acknowledge receipt of the letter of the 6th instant from the Board of Visitors requesting the views of the Academic Board of the U. S. Military Academy relative to the existing methods of appointments and examinations of candidates, and asking whether any changes could be suggested which, in the judgment of the Board, would tend to increase the number of graduates.

This letter was laid by me before the Academic Board at its meeting on the 9th instant, and it received most careful and thoughtful consideration.

Taking up the various subjects mentioned, in their regular order, the Board requests me to state its views as follows:

(1) The Academic Board feels satisfied that with the Academy as now constituted the number of cadets can be increased, but such increase should be very gradual. For the present the Board can only recommend that the privilege of nominating ten cadets each year, instead of ten during four years, shall be restored to the President of the United States. This power was held by the President until its revocation by the act of Congress approved June 11, 1878.

(2) The Board is in favor of some method of examining candidates at various places throughout the United States, as outlined in general terms by the Superintendent of the U. S. Military Academy, but believes that it will require time and consideration to develop the best scheme in detail.

(3) The Board respectfully states that at present it has no suggestions to make as to the method of appointment of candidates for admission.

In submitting the foregoing views, in reply to the communication from the Board of Visitors, I have been requested to state that a minority of the Academic Board is not in favor of any increase of the corps of cadets at this time.

Having expressed in the foregoing the views of the Board, I shall take advantage of your request for individual opinions and present my own, as follows:

(1) I feel assured that the entrance examinations can be conducted without difficulty previous to the arrival of the young gentlemen at West Point, and I would suggest that candidates should be required to report for physical examination to the nearest medical officer of the Army immediately after receiving their letters of appointment, and should they be pronounced physically disqualified for military duty, their appointments can at once be revoked, and they would be spared further expense and mortification; should they *be pronounced qualified they should be admitted without further physical examination.*

(2) Early in April of each year, upon some stated day, I would require all candidates throughout the United States who have letters of appointment and who have been pronounced physically qualified, to appear for mental examination at certain geographical centers throughout the United States, such as Portland, Boston, New York, Philadelphia, Pittsburg, Washington, Richmond, Charleston, Atlanta, Mobile, New Orleans, San Antonio, Memphis, Louisville, St. Louis, St. Paul, Chicago, Omaha, Denver, Cheyenne, Helena, Salt Lake City, San Francisco, Portland, Seattle, and such other prominent places as the Secretary of War shall indicate.

These examinations should be held under the direction of the Academic Board of the U. S. Military Academy, and if necessary members of the Board could be detailed to be present at the more important points.

The questions should be prepared here by the Academic Board, and the examination conducted under the immediate supervision of army officers, acting simply as monitors. Each candidate should write his name upon a slip of paper, and should receive a number corresponding thereto; upon his examination papers his number only should appear. The names with numbers would at once be sent under seal to the War Department, while the examination papers, with numbers only, should be sent direct to the Superintendent of the Military Academy, for the action of the Academic Board.

The Board, after carefully considering all the papers, can at once determine which are satisfactory, and the Adjutant-General can be immediately informed of the numbers of the successful candidates.

The young gentlemen can then be notified, their original signatures sent to the Military Acadamy for comparison when they take the oaths of allegiance, and the candidates will be prepared to go on duty upon their arrival at West Point.

Appointments in place of those who may have failed at this examination can be made without delay, and these additional candidates, who will be few in number, can be promptly examined by the Academic Board as soon as they report in June.

(3) I am in favor of a moderate increase of the number of cadets at the Academy, believing that our plant is sufficient to turn out a larger number of graduates each year.

Such increase should be gradual, and I would suggest, at first, simply restoring to the President the privilege of appointing ten cadets each year, of which privilege he was deprived by the terms of the act of June 11, 1878.

At present the maximum number of cadets authorized is 347; under the new apportionment it will be 372; with the privilege accorded the President which existed prior to 1878, the maximum number will be 402.

The present plant is amply sufficient to care for 402 cadets, and all that will be required will be the detail of a few more officers as instructors and the erection of additional quarters for their accommodation.

Should the demands of the country still render a further increase necessary, I would suggest in the future, after the first increase has been thoroughly tested, that the privilege now accorded members of the House of Representatives, of nominating candidates from Congressional districts, be extended to the U. S. Senate, by giving

Copyright. Stoddard, Glens Falls, N. Y.

CANDIDATES.

each State two cadets at large, to be nominated by the Senators to the Secretary of War.

This increase would necessitate a possible enlargement of the cadet barracks and chapel, an increase in the number of officers as instructors and quarters for their accommodation, an enlargement of the stables and more horses, and an increase in the lighting facilities of the post.

The new academic building, the cadet mess hall, with some minor changes, and the cadet hospital, would, in my opinion, need no enlargement so long as the maximum number of cadets allowed by law does not exceed 500.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Colonel of Engineers, Superintendent.

Major JOHN M. CARSON,
Secretary Board of Visitors to the U. S. Military Academy,
West Point, N. Y.

The Board does not agree with Colonel Wilson that an increase in the corps of cadets, fixing the number at 469, would require enlargement of the cadet barracks. The actual presence of 469 cadets would perhaps necessitate an extension, but it is not probable that, even with the adoption of the plan recommended for appointment and examination, the actual strength of the corps would exceed 400 at any one time. The total number of rooms in the cadet barracks is 208, which will furnish ample accommodation for 416 cadets. For the brief period that the strength of the corps might exceed that number three cadets could be assigned to some of the rooms without sacrifice of personal convenience or risk to health.

VIEWS OF COL. SYLVANUS THAYER.

That the present methods of appointing and examining candidates for admission to the Academy has for many years been regarded as inefficient and faulty is shown by a paper prepared by Col. Sylvanus Thayer 26 years ago. Colonel Thayer was for many years Superintendent of the Military Academy. His administration was so marked by conspicuous ability as to gain for him the title of "Father of the Military Academy," and to secure a monument on the parade ground in the form of a life-size statue erected by the graduates of the institution. The last visit made to the Military Academy by Gen. U. S. Grant was to attend the unveiling of the statue of Colonel Thayer. The Board is indebted to Adjutant-General John C. Kelton for a copy of this paper of Colonel Thayer. General Kelton has given this general question much observation and study. No officer in the Army has had better opportunities for intelligent examination of the question, and no military officer has exhibited greater zeal in all that relates to the intellectual progress of the Army, the advancement of its morale, and promotion of its personal comfort than General Kelton. In a letter to

the secretary of the Board of Visitors, directing attention to the paper of Colonel Thayer, Adjutant-General Kelton says:

WAR DEPARTMENT, ADJUTANT GENERAL'S OFFICE,
Washington, June 9, 1891.

DEAR MAJOR CARSON: My observation and study of West Point has long ago convinced me that the method of appointing cadets is a failure.

The plan of Colonel Thayer, the father of the Military Academy, proposed in 1865, modified to suit present conditions, would probably be a success in securing the best representation for each Congressional district, and be the means of greatly increasing the number who could be graduated.

If, in addition to this method of securing the best candidates, the course of study at West Point should be divided at the end of the second year, giving all those members of a class who show marked proficiency in mathematical studies, and who have expectation for the Engineers, Ordnance, and Artillery, the present four years' course of instruction, and those who in the first two develop no special aptitude for mathematics a different course of study, but one more helpful in preparing them for commissions in the infantry and cavalry, I believe many more candidates could be graduated.

I am induced to send Colonel Thayer's project and to make the foregoing remarks upon seeing newspaper reference to the efforts the Board of Visitors are making this year to improve the quality of the candidates and increase the number to be graduated.

After making such use of Colonel Thayer's "Propositions and suggestions for the improvement of the U. S. Military Academy" as you may deem proper, please restore the paper to the files of the Department.

Very truly yours,

J. C. KELTON,
Adjutant-General.

Maj. JOHN M. CARSON.

Colonel Thayer's paper is entitled "Propositions and Suggestions for the Improvement of the U. S. Military Academy." Some of the recommendations had more force and application 25 years ago than at the present time. While the Board does not approve all the recommendations of Colonel Thayer, it contains so much that is of value at this time and in this connection that his paper is given entire. In this paper Colonel Thayer discusses the curriculum of the Academy, and advocates certain changes which will doubtless startle many of the older graduates. This portion of the paper properly belongs to the chapter of this report devoted to discipline and instruction. It is deemed best not to divide Colonel Thayer's paper, and it is therefore inserted entire in this place. The paper has laid in the files of the War Department for 25 years, its existence known to comparatively few persons. It is now printed for the first time. The paper is as follows:

PROPOSITIONS AND SUGGESTIONS FOR THE IMPROVEMENT OF THE U. S. MILITARY ACADEMY.

The Corps of Cadets to be increased so that it shall consist of 400 members
e further increased whenever accommodations for a greater num-
d.

Second. The present mode of appointing cadets, viz., on nomination by members of Congress, be done away with.

Third. The admission of cadets to be made dependent on the results of an open competitive examination, conducted with perfect fairness to all concerned.

Fourth. No candidate to compete who, at the time of joining the Academy, shall be under 17 or over 20 years of age, excepting candidates who shall have served not less than 6 months in the Army, who may be examined if not over 24; and no candidate shall be permitted to compete who does not produce satisfactory testimonials in regard to his moral habits and character, nor shall the name of any candidate be placed on the roll of those found qualified for admission unless, besides the requisite physical qualifications, he shall have passed a satisfactory examination in each and all of the subjects specified in the next following (fifth) proposition.

Fifth. The subjects of the competitive examination shall be:

(1) Reading distinctly and understandingly.

(2) Writing legibly and fairly.

(3) Spelling correctly.

(4) English grammar, so as to analyze and construe any ordinary English sentence.

(5) Descriptive geography.

(6) Arithmetic—ground rules, fractions (vulgar and decimal), ratios and proportions.

(7) Algebra—gruond rules, fractions, simple equations, discussion and solution of quadratic equations.

(8) Geometry—therems and problems of plane geometry.

Sixth. The board for the examination of the candidates to consist of three members, two of whom to be selected from military officers, graduates of the Academy; the third member to be a civilian, a professor in some college, or any other person of well known competency, who is a resident of the State in which the examination is held.

It shall be the duty of the board to examine the candidates belonging to each State, separately, at the time or times and at the place or places fixed therefor, in each and all the branches required for admission, and thereupon to make out a special merit roll, for each branch, and from the special merit rolls a general merit roll, from the head of which will be taken in numerical order the number of cadet appointments to which the State may be entitled.

Seventh. Paragraph 18 of the Academy Regulations, edition of 1857, to be stricken out, and Article II to be modified, so as to conform to the foregoing propositions.

Eighth. Paragraph 23 to be modified so as to read as follows: "French grammar, reading French with a correct pronunciation, translating French into English readily and correctly."

Ninth. The Spanish language to be stricken from the regular course of studies and taught only as a voluntary study to such cadets as, in the opinion of the Academic Board, are capable from previous acquirements of pursuing the study without detriment to their progress in the obligatory studies.

Tenth. The subjects enumerated in paragraph 25 to be greatly abridged, and only so much of chemistry and its applications taught as are necessary or essentially useful to the military engineer or artillery officer.

Eleventh. Some of the branches named in paragraph 32 to be eliminated.

Twelfth. The present mode of examining cadets for advancement from class to class and for commissions in the Army, and also the present mode of forming the merit rolls to be submitted to the Board of Improvement for revision.

Thirteenth. A military officer, selected from the graduates of the Academy, and known to possess a thorough knowledge of all the sciences and subjects taught at the Academy, to be appointed inspector of studies, whose duty it shall be, under the direction of the Superintendent, to exercise a general supervision and control over the studies and instruction. He will give daily attendance at the recitations and lectures, notice the manner in which the professors and instructors discharge their

duties, respectively, and see that programmes and methods of instruction prescribed by authority are strictly and uniformly conformed to. In consultation with the professors and instructors, severally, he will arrange the studies and instruction, with a view to the best adaptation to the capacity of the different sections, and will decide in cases of transfer from section to section. He will receive from the professors and instructors the weekly class reports, enter the merit marks in the register kept for that purpose, and make a monthly report to the Superintendent on the progress of the studies, accompanied by a consolidation of the weekly class reports. He will also make an annual report, to be submitted to the Board of Improvement.

Fourteenth. A Board of Improvement to be appointed, composed of the Superintendent, inspector of studies, and of not less than three or more than five other members, a majority of whom to be military officers, graduates of the Academy, but not connected therewith. The principal duty of the board shall be to revise the programmes and methods of instruction, to point out defects therein, and to propose the proper remedies and ameliorations. The board will be present at all general examinations, and immediately after each annual examination will make a report to the Secretary of War on the progress of the studies and on the condition and management of the institution, so far as relates to the studies and instruction, and recommending such changes therein as observation and experience may have shown to be expedient.

Fifteenth. The term of residence at the Academy during war to be two years.

Sixteenth. The term of residence at the Academy during peace to be four years.

Seventeenth. The board of improvement to be assembled in special session at West Point as soon as practicable, with instruction to take under consideration the entire system of studies and instruction at the Academy; and in consultation with the professors and instructors to prepare programmes and tables for the distribution of the studies and employment of time adapted to the four years' term, and also for the proposed two years' term, the subjects of study and instruction in the programmes to be so detailed and defined that nothing shall be left to the discretion of the professors and instructors as to the matter to be taught or the *amount* of instruction to be given.

Eighteenth. The Superintendent, the inspector of studies, the commandant of cadets, with three of the senior professors, all of whom to be graduates of the Academy, shall constitute a board which shall be called the board of administration. It shall be the duty of the board to examine all text-books proposed by the head of each department of instruction before submitting them to the board of improvement for adoption by the Secretary of War; to recommend to the Secretary of War for purchase all such books, maps, models, and apparatus as may be required for the purposes of instruction, also such works as may be deemed most suitable for the yearly increase of the library; to recommend to the Secretary of War such changes in the regulations as experience may suggest, and to perform all other functions hitherto assigned to the Academic Board, except those pertaining to the examination and graduation of the cadets.

Nineteenth. A board of discipline to be appointed, composed of the inspector of studies, the commandant of cadets, and of three other members selected by the Secretary of War from military officers on duty at the Academy.

It shall be the duty of the board to inquire into and investigate the facts in all cases referred to it, touching breaches of the regulations, and other offenses reported to have been committed by a cadet or cadets, or by a person or persons unknown, and to report its proceedings in each case to the Superintendent, with its opinion, when required, as to the guilt or innocence of the party accused or implicated, and also as to the nature and degree of the punishment, if any, proper to be inflicted.

Twentieth. Paragraph 110 to be modified so that courts-martial for the trial of cadets may be dispensed with in all ordinary cases, and that punishment may be inflicted in the following manner, viz: Those of the second class, specified in paragraph 109, by the Superintendent, on recommendation of the board of discipline; those of the

third class by the Secretary of War, on recommendation either of the board of discipline or Academic Board, approved by the Superintendent.

Twenty-first. The second and third paragraphs of the Academy Regulations, edition 1857, to be replaced by the corresponding paragraphs of the regulations in force *from* 1817 to 1839.

Remarks referring to corresponding numbers of the foregoing propositions.

First. In order that all the vacancies in the Regular Army on the peace establishment, not filled by promotion from the ranks, may be filled by graduates from the Military Academy, the strength of the Corps of Cadets must be largely increased. Five hundred, or 600, would, probably be necessary to that end, but, as the existing buildings at West Point are not calculated to accommodate more than 400, that number is proposed as the proper limit *for the present.* But as the object of the Academy, in the minds of its founders, was not only "to supply vacancies in the Regular Army but also to diffuse military instruction throughout the Union," the number of cadets should, as soon as practicable, be so increased that the Academy could turn out, annually, a large surplus of graduates over and above the number necessary to fill the vacancies in the Army. These supernumeraries should be regarded as retired officers *without pay*, waiting to be called into active service in time of war; meanwhile, as civil engineers, professors in colleges, teachers of scientific branches, and also, at least, many of them, as militia officers, "diffusing military instruction throughout the Union," they would be rendering service to the country more than equivalent to the cost of their education at the Academy.

Assuming 400 to be the number of cadets at the Academy, and that the President may think proper to reserve a certain number of places, say twenty, to be given to the sons of soldiers and officers of the Army and Navy, who, having no settled habitat, can not be classed as residents of any particular State or Territory, the remainder, say 380, would be so distributed among the States and Territories that each would always have at the Academy a pro rata representation, based upon population or congressional representation.

Second. The present mode of appointment was adopted at a time when the existence of the Academy was believed to be in jeopardy and to be saved only by conferring on Members of Congress a coveted patronage; but now, when the Academy seems firmly established in public favor, it may, it is hoped, be safely left to stand on its own merits, independently of all questionable helps. Whether the appointment of cadets by Members of Congress is not contrary to the spirit, if not to the letter, of the Constitution; and, also, whether it is not liable to abuse by unscrupulous members, are questions that may be worthy of serious consideration in proper time and place, but here I need only call attention to the undeniable fact that it fails to procure for the Academy proper subjects to be educated at the public expense.

The records of the Academy show that the number of cadets *admitted*, compared with the number *graduated*, stand as five to two; that is so say, three-fifths of the cadets admitted are found incapable of going through, being removed, some during the first six months, others only after a residence varying from 1 year to 4 or 5 years. Of the two-fifths who are graduated, many succeed only by dint of intense application and the great pains bestowed upon them by their teachers. Men of this stamp, although they make meritorious officers in subordinate positions, are rarely successful in independent and responsible commands. The remedy for the evil is, evidently, only to be found in some means by which the mental capacity of the candidate may be fairly tested and measured, and his ability to master the course of studies at the Academy may be judged of with some degree of accuracy; and the only means to that end yet tried and found successful in other countries is a high standard of attainment, joined to open competitive examinations for admission, means that could not fail to procure for the Academy youths who are the *elite* of the nation. Objections, if any, to admission through competitive examinations can come only from the very few who profit by the patronage derived from the pres-

exist under appointment; but the people, minus these few, can only desire that their army may be supplied with the best officers the nation can furnish: officers who will know how to win victories.

Third. Open competition for entrance into her military schools was adopted by the French Republic 70 years ago, and has been maintained to the present day, and all the other European governments, including that of Great Britain, have been compelled, one after another, to follow her example. It is remarkable, and seems little creditable, that the great model republic, of which we are justly so proud, should be the last to give up patronage, the policy of aristocratical and monarchial governments, and, also, the last to adopt the republican principle of open competition, which seeks out and rewards the most worthy, wherever to be found, without distinction of class or condition, race or color.

Fourth and *Fifth.* The standard of attainment proposed is not, by any means, as high as is desirable, or, indeed, as is necessary as a test of the candidate's capacity, and of his ability to master the course of studies at the Academy. It is lower than at Woolwich, far lower than at St. Cyr, Wiener-Neustadt, or any similar institution in other countries, but it is hoped that it may be raised gradually, *pari passu*, with the improvement of the common schools.

In view of the importance of French and drawing to progress after admission, and of Latin to the acquisition of French, I would recommend that the candidate, at his option, be admitted to an examination in all or either of those branches, and that some weight be given to them in forming the general merit roll of those who are found qualified for admission.

Sixth. It may be expedient, perhaps, to constitute a separate board for the examination of candidates belonging to States on the Pacific.

The place or places designated for the examinations should be central in regard to population, or as nearly so as practicable; one place only in the smaller States, two or more in the larger; for instance, in New Jersey, Princeton or Brunswick; in the State of New York, New York City, Albany or Schenectady, Geneva or Rochester; in Massachusetts, Boston and Springfield, or Amherst.

The regulations requiring the candidate to repair to West Point to be examined for admission, he paying his own expenses to that place, and if rejected back to his home again, is not only unequal and often oppressive in its operation, but also in effect excludes many of the poorer class from the benefits of an institution that should be equally open to all.

Seventh. An open competitive examination and a high standard of attainment for admission would accomplish the object in view better than the probation exacted by paragraph 18; besides, the cadet should consider himself on probation during the whole period of his residence at the Academy, and liable to be removed at any time for want of capacity, or for want of application, as well as for deficiency in moral or military conduct.

Eighth. All books not in English, the reading or study of which can be useful to an officer of the U. S. Army, are either by French authors or are translated into French; hence French is justly regarded as the "key of military science;" but no more time should be bestowed upon it at West Point than would enable the pupil to read French with facility without the help of a dictionary. The additional time that would be necessary to speak French or to translate English into French (which no officer of our Army would probably ever be called upon to do in the line of his profession) would be more usefully applied to other subjects, a knowledge of which is indispensable to the military officer.

Ninth. The reasons above given for teaching French as an obligatory study do not [illegible] least to Spanish. The only pretext there can be for teaching it at West [illegible]able the pupil to carry on a conversation in Spanish, in the very doubt- [illegible]over having occasion to speak it in the line of his profession before he [illegible] want of practice. But here it is pertinent to inquire whether any

class, or even any individual not previously grounded in the language, ever made at West Point such proficiency as would enable them, or him, to carry on a conversation in Spanish. But whether that degree of proficiency has been attained or not, I am clearly of opinion that Spanish should be eliminated, giving place to more important *subjects* which its introduction crowded out or unduly contracted.

Tenth. "Bleaching," "dyeing," "tanning," "gilding," "distilling," and much other extraneous matter may well be excluded from the programme. The subjects of this course should be taught mostly by lectures, and, limited as proposed, need occupy less time than is now allotted to them.

Eleventh. The numerous subjects comprised in paragraph 32 occupy more time than is due to their relative importance, and yet not enough for teaching them as they should be taught to be useful. "English grammar and descriptive geography" are among the proposed requisites for admission. "Physical geography," if retained, might be transferred to the department of natural philosophy, or taught in connection with geology. "Political geography" and the "history of literature" may well be excluded, and also civil history, except a few lectures to teach how history should be studied; the time thereby saved to be applied partly, if deemed necessary, to the more important subjects of the course, viz, moral philosophy and law, constitutional and national, and the remainder distributed in due proportions between military engineering and French, both of which have been encroached upon by the undue expansion of the department of ethics. The branches proposed to be eliminated or restricted crept in at a time when the notion seemed widely prevalent that the object of the Academy was, or should be, to educate young men for the bar and the pulpit, rather than for the Army.

Twelfth. The manner of conducting the annual examination, and also that of forming the merit roll, as prescribed in paragraphs 62, 65, and 67 of the regulations, edition of 1857, are believed to be susceptible of material improvement. The examining committee should be so composed that *every* member of each committee shall be capable, by a thorough and familiar knowledge of the subjects, of forming an intelligent judgment of the performance of the examinee, and the number of committees should be such that, by their simultaneous action, the annual examination may be confined within the narrowest limits of time compatible with a thorough and searching examination of the pupils. These desiderata may, it is believed, be secured by means of seven committees, composed as follows: (1) For mathematics, the professor, the principal assistant professor, the instructor of the section under examination, together with not less than two other members not connected with the Academy, selected from experienced and successful teachers of mathematics; (2) for natural philosophy and for chemistry, mineralogy and geology, a single committee, consisting of the two professors and their principal assistants and the instructor of the section under examination, together with not less than two members of known competency not connected with the Academy; (3) for engineering, the professor, the principal assistant professor, the instructor of the section under examination, together with not less than two officers of the Corps of Engineers, not under the grade of captain and not connected with the Academy; (4) for artillery, cavalry, and infantry tactics, and for ordnance and gunnery, a single committee, consisting of the instructors of those branches, together with at least three officers, graduates of the Academy, not under the grade of a field officer, selected from the artillery, cavalry, and infantry, to represent those arms respectively; (5, 6, and 7) for ethics, French, and drawing, the committee for each to consist of the professor, the principal assistant professor, the instructor of the section under examination, together with two or three members appointed by the Superintendent from members of the Academic Board not on other committees, or from the Board of Visitors, or from acting assistant professors, or other officers on duty at the Academy.

The inspector of studies and the Superintendent to be *ex officio* members of any of the committees, and when present to preside therein.

The duration of the annual examination will necessarily be determined by the time it takes to examine the pupils in mathematics, that time being more than is required by any other committee to finish its task. If, owing to the increase of the Corps of Cadets or any other cause, the examination in mathematics can not be brought within the limits of 15 working days, it may be expedient to constitute two committees for that subject.

The numbers representing the value or weight given to the different subjects are not apportioned according to their relative importance or to the time allotted to them, respectively, nor apparently according to any just principle. In forming the general merit rolls of the three lower classes (second, third, and fourth) too much weight is allowed to conduct. If allowed any weight at all, it should be merely enough to turn the scale when merit in scholarship is equally balanced. To give it more weight is simply to weaken the incentives to study, which was the sole object of the merit-roll system. The arm of discipline, if skillfully wielded, is strong enough of itself, needing not to be aided in a way that is injurious to progress.

Thirteenth. The office of inspector of studies in the Royal Military Academy at Woolwich was created in 1772, and still exists. It is filled by a lieutenant-colonel of engineers or artillery, whose salary is $1,500, in addition to his regimental pay and allowances, amounting in the whole to $3,500. The officer performing the same functions in the military schools on the continent is styled (more appropriately) director of studies.

From the year 1817, when the present system of studies and instructions at the Academy was established, to 1834 or later, the Superintendent was charged with the duty of directing the studies, a duty he discharged to the best of his ability, as far as it was consistent with his other indispensable duties, but the duty is such as to require for its proper performance the entire and continuous attention of an officer. By a change in the regulations first promulgated in 1839, it ceased to be the duty of the Superintendent to direct the studies, and ever since each professor has been the supreme director of studies in his own department. The evils experienced from there being no officer at the Academy charged with the general control of the studies are such as to demand a speedy remedy.

The inspector of studies should be second in command, and supply the place of the Superintendent when absent.

The importance and utility of a properly constituted body to point out defects and suggest ameliorations in the system of studies and instruction at the Academy seem too obvious to need demonstration or argument. Such a body, styled (Counseil de Perfectionment) board of improvement, has been found necessary to the proper working of the machinery of instruction in all the best European military schools. Some of the evils experienced at West Point for the want of such a board will be noticed in connection with proposition 17.

The board should be of a permanent character in order that the Academy may have the benefit of its accumulated experience and be the more secure against rash experiments and innovations made to cure imaginary evils, or to effect chimerical improvements. A system found to have worked well for many years should not be *tampered with*, or be subject to other changes than such as enlightened experience indicates to be safe and expedient.

Fifteeth and sixteenth. The duration of residence at military schools is determined mainly, *cæteris paribus*, by the standard of attainment for admission; the higher the standard the shorter the time, and *vice versa*, the limits being 2 and 4 years. The term at Addiscombe, Sandhurst, and St. Cyr is 2 years; at Woolwich, 2 years for the theoretical course, and 6 months more for the practical course. The term at Wiener-Neustadt, Austria, is 4 years, although the standard is higher than at either of the other above-mentioned schools, excepting St. Cyr. With the standard raised as herein proposed, 4 years is ample for the course at West Point; *provided, however*, that Spanish is eliminated and the other subjects not intimately

connected with the knowledge absolutely necessary to the military officer shall be properly restricted. With the same standard, a course of studies and instruction comprising all that is absolutely necessary for practical purposes may, in my opinion, be completed in *two* years. The outlines of such a course will, if requested, be submitted for a rigid scrutiny to the board of improvement.

Assuming the term in time of war to be 2 years and the number of cadets at the Academy to be 400, constituting a battalion of eight companies, it would seem to me best to divide the cadets into four semiannual classes, a class to be admitted and a class to be graduated every half year. With the standard of capacity raised, as it would be by the means proposed, it may be safely calculated that nine-tenths of the cadets admitted would go through, and that the cost of each graduate would be reduced to about one-third of the present cost.

Seventeenth. That there is something wrong, either in the arrangement of the studies or in the methods of instruction, is acknowledged by the professors themselves, although every one may not see that all is not right in his own department. The following statement, incidentally made by one of the professors, gives a glimpse of the nature of the evil in question: "Few, except the highest members of the class, seem to have retained anything of the higher analysis, and the grossest blunders are frequently made, even in the elements of algebra and geometry, either through forgetfulness or negligence. Many who graduate would seem to have been very little benefited by their past studies, so far as the retention of what they had once learned is concerned."

The evil is by no means confined to a single class or department, nor can it fairly be imputed to the professors and instructors, who are unsurpassed in the art of teaching. Traced to its sources, it is found, mainly, in the third article of the Regulations, which, by prescribing merely a syllabus or outline of the studies in each department, leaves the filling in to the professor, and thereby makes him, in fact, the constructor of his own programme. The natural consequence is that the pupil is overtasked, "crammed;" more mental food is given him than the mind is capable of digesting. There is too much abstract theory; not enough of the practicable application to impress the theory on the memory, so as to make it durable and practically useful.

The nature of the evils being known, and its cause also, the remedy is plain. First, there must be well devised programmes prescribed by authority, describing in the most minute detail the instruction, both in kind and amount, to be given in each department for ethics, French, drawing, and for chemistry, minerology and geology, one programme each; for mathematics, natural philosophy, and engineering, two programmes each, a maximum and minimum, the former adapted to the capacity of the first or highest section, the latter comprising only those subjects in which every pupil must pass a satisfactory examination before he can be advanced to a higher section, or be recommended for a commission; the maximum programme to be modified for the intermediate section or sections between the highest and lowest, by excluding therefrom more or less of the more difficult subjects and investigations (in the discretion of the inspector of studies), so that the studies and instructions shall be duly proportioned to the capacity of the said section or sections. Second, it must be made the duty of the inspector of studies to see that the programmes are strictly adhered to, and that the lessons given out by the instructors are duly proportional to the time set apart for their study or preparation.

The preliminary steps necessary to be taken for obtaining these programmes are, first, to require each professor to prepare a detailed programme of the instruction given in his department (in the last academical year), divided into lessons, with an estimate of the time, in hours, a pupil of fair abilities with proper diligence will require to master each subject and lesson, stating, separately, the time necessary for preparation and that for attendance at recitations and lectures. Second, the programmes so prepared to be referred for revision to the board of improvement at the earliest period practicable. And it is recommended that the board, in drawing up

the general programme of studies and instruction proper to be included in the 4 years' course, be instructed to consider the expediency of the following distribution of the subjects: (1), the studies and instruction of the first class (fourth year) to be confined to military subjects exclusively, viz: fortification, field and permanent, with attack and defense, and all other subjects proper to be included in the course of military engineering, theoretical and practical; ordnance and the science of gunnery, the organization and movement of armies, field service, principles of strategy, military administration, military law and Army Regulations, and all other subjects comprised in the terms "Military science and art." (2), the instruction given by the professor of drawing to be confined to the first and second years (third and fourth classes) and the studies and instruction of the third and fourth classes to be confined to mathematics, French and drawing, exclusively. (3), natural philosophy and chemistry, mineralogy and geology, and all other subjects proper to be included in the 4 years' course of studies and instruction (exclusive of those specified under Nos. 1 and 2), to be confined to the third year (second class.) (4), 10 hours daily (average time) from September 1 to the annual examination in June to be given to the above-mentioned subjects. (5), so much of the theory of tactics (artillery, cavalry, and infantry) as shall not be included in the fourth years' course, to be taught during encampment only.

The reasons for the distribution of studies above proposed will, if requested, be submitted to the board of improvement when the subject is taken up for consideration.

Eighteenth. The proposition to be submitted for paragraph 10 of the Academy Regulations, edition 1857. The change is suggested by my own experience while superintending the Academy.

Nineteenth and twentieth. At Woolwich Academy, in an early period of its existence, cadets were brought before a court-martial in order to their dismissal, but the practice having been found to work badly was soon discontinued. At no other foreign military school, if I am correctly informed, has a pupil at any time been brought before a court-martial. At West Point, from 1803, when the Academy was founded, up to about 1820, no cadet was brought before a court-martial. The power of dismissal rested in the Superintendent, and his action in every case was *final*, and at no time since has there been a sounder state of discipline and morals at the Academy than during that period generally.

The principal objections to trial of cadets by court-martial are: (1) Its demoralizing tendency, the cadet witnesses being under a strong temptation to conceal or withhold their knowledge of facts when the punishment of a beloved comrade is in question. (2) The impunity it affords to the most criminal of the offenders, those who plan, instigate, and pull the wires, but in such manner that no legal evidence can be produced against them when arraigned. Nevertheless, these invisible contrivers and leaders of mischief are well known to the authorities, and unless they may be removed without the formality of a trial a sound and satisfactory state of morals and discipline at the Academy is out of the question. If indeed there be any law which by a fair construction prohibits the dismissal of a cadet unless by sentence of court-martial, the law should be repealed and the President empowered to establish such rules and regulations for the government of the Academy as shall seem to him necessary and proper. The idea of governing boys at school, albeit a military school, by the laws and rules made for the government of an army is manifestly absurd.

Twenty-first. The paragraphs proposed to be restored (see Academy Regulations, editions of 1832, or any previous editions published after 1817) are as follows:

"Paragraph 2. A *permanent* superintendent of the Academy, *appointed from the Corps of Engineers*, will have the immediate government of the institution, *and be held responsible for its correct management. He will direct the studies*, field exercises, and all other academic duties, and all professors, *teachers*, academic officers and cadets shall be under his command. He will render all returns, estimates, and communications concerning the institution to the inspector.

"Paragraph 3. No officer of the Army *of any rank whatever* shall exercise command in the Academy unless subordinate to the Superintendent."

By comparing the foregoing with the corresponding paragraphs now in force, which were first published in the 1839 edition of the regulations, it will be seen that the words *underscored* in the second paragraph were stricken out, without other change, and that in the place of the words *underscored* in the third paragraph, the following words were inserted: "Except the commandant of the Corps of Engineers." These changes, which could not have been made without design, changed completely the office and position of the Superintendent. He was no longer a *permanent* superintendent, but filled the office, as it were, by *routine*. It ceased to be his duty to "direct the studies." He was no longer held responsible for "the correct management of the institution," nor indeed could be, as power and responsibility are correlative terms. In proportion as the former is restricted the latter is diminished, and there remained only a common or a divided responsibility, subsisting between the Chief Engineer and the Superintendent, which, as it seems to me, is little better than no responsibility at all. Whether these changes have inured to the benefit of the Academy may be best answered by the three senior professors, who have been members of the institution from 40 to 44 years.

The office of permanent superintendent was created by President Madison in 1816, on full consideration, after consulting with Mr. Monroe, president-elect, and with the Secretary of War, and from a conviction of its necessity, in view of the previous history of the institution. The person whom he designated for the office continued to fill it for the full period of 16 years, terminating in 1833. Since then there have been eight changes in the office, each change bringing with it naturally some changes either for the better or for the worse in the management of the institution. There are few persons, probably, in the military service of our own or of any other country, who possess the peculiar qualifications fitting them, in all respects, to govern a grand military school like that at West Point, and when the person selected for the position is found on trial to be the "right man in the right place," an over-ruling necessity only would justify his removal.

Respectfully submitted.

S. THAYER,
Colonel of Engineers.

COMPETITIVE AND DIRECT APPOINTMENTS.

The relative merits of appointing candidates direct and by competition has been discussed in previous reports, by the newspaper press, and in Congress. This Board was divided in sentiment as to the merits of the two systems and concluded to merely present figures covering a number of years and showing the results obtained under each system. The table given below covers all the classes which have left the academy from 1873 to 1891, inclusive. It shows the total number of candidates appointed for each year during that period, the number appointed by competition, and the number graduating who were appointed under each system. It will be noticed that under the competitive system 60 per cent. graduated and 40 per cent. failed to graduate, while of those appointed direct only 42 per cent. graduated and 58 per cent. failed. It will be also noticed that fo: the 15 years covered by the table the number admitted was 1,588, of whom only 789, or one-half, graduated.

Number of cadets admitted to the U. S. Military Academy from 1873 *to* 1891, *inclusive, showing number appointed by competitive examination and directly, with number graduated and casualties under each mode of appointment.*

Year of entering.	Total number admitted.	Appointed by competition.						Appointed directly.					
		Graduated.	Resigned.	Discharged.	Dismissed.	Died.	Total.	Graduated.	Resigned.	Discharged.	Dismissed.	Died.	Total.
1873	118	34	3	10	.....	.....	47	42	10	19	.....	.....	71
1874	89	13	4	10	1	.....	28	27	10	22	2	.....	61
1875	121	30	8	6	2	...	46	34	18	22	1	.....	75
1876	98	23	4	16	.....	2	45	24	11	16	1	1	53
1877	96	36	4	11	.....	.....	51	20	8	13	4	.....	45
1878	102	22	7	13	1	.....	43	17	23	19	.....	.....	59
1879	88	29	4	14	.....	.....	47	13	14	14	.....	.....	41
1880	73	23	3	5	1	.....	32	14	12	15	.....	.....	41
1881	85	19	6	8	.....	.....	33	24	10	18	.....	.....	52
1882	129	40	7	12	.....	1	60	35	11	23	.....	.....	69
1883	141	*37	10	20	2	1	70	*30	16	23	1	1	71
1884	98	24	2	14	.....	2	42	18	7	30	.....	1	56
1885	95	21	0	9	1	.....	40	24	8	23	.....	.....	55
1886	128	44	8	22	.....	.....	74	18	6	29	.....	1	54
1887	127	39	5	19	.....	2	65	15	12	24	.....	.....	51
Total	1,588	434	84	189	8	8	723	355	176	310	9	4	854

* Including eight cadets turned back into the class of 1888.

	Per cent.
Competitive:	
Graduated	60
Failed to graduate	40
Direct:	
Graduated	42
Failed to graduate	58

The annexed table shows the number of candidates admitted and the number found deficient under the direct and competitive systems, respectively, for the 19 years ending with August, 1891. As in the preceding table, the result is decidedly favorable to the competitive system.

Number of candidates admitted and found not duly qualified at preliminary examinations for admission to the Military Academy from 1873 *to* 1891, *inclusive, by appointment under the competitive and direct methods.*

Years.	Competitive.		Direct.		Years.	Competitive.		Direct.	
	Admitted.	Not duly qualified.	Admitted.	Not duly qualified.		Admitted.	Not duly qualified.	Admitted.	Not duly qualified.
1873	57	16	61	58	1884	40	12	58	30
1874	26	10	63	56	1885	41	7	54	26
1875	46	20	75	47	1886	74	25	54	20
1876	38	11	60	42	1887	70	20	57	36
1877	46	27	50	60	1888	42	18	59	38
1878	40	6	62	39	1889	34	14	62	54
.....	46	13	42	21	1890	39	12	43	41
.....	32	10	41	24	1891	43	14	54	26
....	33	18	52	42					
...	62	12	67	39	Total	878	277	1,086	743
..	69	12	72	44	Per cent	76+	24+	59+	41+

REPRESENTATIVE CHARACTER OF THE CADET CORPS.

It is sometimes contended in discussing the merits and usefulness of the Military Academy that its students are selected from special classes and frequently through favoritism. This allegation was effectually refuted by the Board of Visitors for 1887 in a table showing the occupation of the parents of cadets admitted for the period embraced from 1842 to 1887. In presenting the table the Board very justly said that "the Corps of Cadets is a typical representative body of the American people. The lower House of Congress is not more representative in this respect than the Corps of Cadets." An examination of the table shows that cadets are drawn from all ranks and classes of the people. We have supplemented the table in the report for 1887 by another which covers the intervening years, including the present year, thus preserving the statistics on this subject from 1842 to 1891, a period of 50 years.

The following table shows the occupations of the parents of candidates for admission to the Academy for 1887, 1888, 1889, 1890, and 1891:

Occupations.	Number.	Occupations.	Number.
Agents	15	Musician (band leader)	1
Architects	1	Marble dealer	1
Artists	2	No occupation	7
Bankers	2	Officers of the Army	43
Bank officers (6 of them bankers)	12	Officers of the Navy	4
Barber	1	Oil producer	1
Brewer	1	Physicians	50
Brokers	6	Pilot	1
Builders	3	Policemen	2
Clergymen	11	Politician	1
Clerks	17	Presidents of Insurance Company	3
Collectors	2	Printers	6
Commercial travelers	4	Professors	2
Contractors	8	Publisher	1
County officers	5	Ranchmen	2
Dentist	1	Real estate	7
Editors	9	Railroad officers	8
Engineers, civil	6	Salesman	1
Engineers, mechanical	6	School teachers	6
Farmers and planters	145	State officers	4
General business	5	Stock dealers (cattle)	4
Hotel keepers	8	Superintendent of gas works	2
Insurance business	5	Steamboating	1
Laborers	5	Unknown	2
Lawyers and judges	80	U. S. civil officers	6
Liveryman	1	Druggists	3
Lumbermen	3	Dairyman	1
Manufacturers	19	Bookkeepers	5
Mechanics	38	Librarian	1
Members of Congress	5	Postmasters	3
Merchants	92	President of Steam Heating Company	1
Millers	2	Fishing master	1
Mining	4		

DISCIPLINE AND INSTRUCTION.

Committee on Discipline and Instruction.—Messrs. JAMES T. MURFEE, FRANK A. O'BRIEN, and THEODORE S. PECK.

THE DEPARTMENT OF MODERN LANGUAGES.

In the choice of professors for the Military Academy the practice has obtained of limiting the selection to officers of the Army. When the chair to be filled bears an intimate relation to the science of war, this is a highly proper and prudent course to follow, but it is the reverse when the vacancy to be filled is the head of one of the departments which do not necessarily sustain such relationship. It can not be successfully contended that a man should be selected as a professor of modern languages, of ethics, or of drawing, primarily because he has been a successful soldier and an accomplished master of strategy. The construction of roads and bridges, the erection of fortifications, the fabrication of guns, or the movement of large armies, have no relation to the construction of syntax nor the conjugation of verbs. To take a man from the Army because of his rank and abilities as a soldier, and make him professor of modern languages at the Military Academy, is a proposition so absurd that many persons will doubtless express surprise that it should be even stated in this Report. Yet such has been the practice of the War Department in this connection, and unless the honorable Secretary of War directs the attention of the President to this important matter, and urges a change in the custom that has obtained, there is reason to apprehend that it will be used to convert a good soldier into an incompetent professor within a very short period of time.

On the 31st of August, 1892, the present professor of modern languages, Col. George L. Andrews, will be retired on account of age. Already a large number of officers of the Army are putting forth efforts to have themselves named for the prospective vacancy. It is perhaps safe to say that few, if any, of these military applicants, however able, accomplished, and distinguished as soldiers, possess the qualifications, attainments, and training to properly discharge the duties of so important and responsible a position. It does not follow that the qualifications and attainments of the high order required to make a competent professor of modern languages are not to be found in the U. S. Army, but there is very slight probability of such a discovery being made, and it is absolutely certain that if any one of the leading colleges or academies of the country were in need of a professor of lan-

Copyright. Stoddard, Glens Falls, N. Y.

"SETTING-UP" DRILL.

guages or a professor of drawing, it would never occur to those having the responsibility of selection to search the ranks of the Army for the required talent and experience.

A scholar and not a scientist, a rhetorician rather than a mathematician, is demanded at the Military Academy at the head of the Department of Modern Languages. Such a man would be the active agent of not only adding efficiency to the instruction in French and Spanish, but would naturally strengthen the instruction in English, which is now so indifferently regarded by the authorities as to be limited to the first year and ranked with Spanish at the minimum value. We agree with Professor Andrews that more time should be given to the study of English, and we believe if a properly qualified teacher be selected to succeed to the head of the Department of Modern Languages he would so manage that more time would be devoted to the study of English without adding to the present mental burden of the cadet. The deficiency in English at the Academy is made painfully apparent to all who attend the annual examinations, and has been a theme for annual comment and deprecation by the Board of Visitors. Young men are admitted to the Military Academy at the age of 17 years, in a majority of cases with no education other than that afforded by the public schools; and yet these young men, after brief study and occasional recitations from such elementary books as Whitney's Essentials of English Grammar, Hart's Manual of Rhetoric and Composition, Abbott and Seeley's English Lessons for English People, and Abbott's How to Write Clearly, are finished in English and graduated in that study at the expiration of 10 months. The value placed upon the study of English by the Academic Board may be inferred from the brief time devoted to its study, and this estimate is emphasized by the fact that in the mathematical measurement of the entire four years' course of studies, which is placed at the maximum of 2300, English is rated at 75. These facts in themselves furnish the most urgent reasons for abandoning the policy of selecting soldiers for professors of such departments at the Military Academy as have no relation to the science of war, and appeal for the introduction to the Academic Board of men from the leading colleges of the country who are known to be fully qualified for the successful performance of the duties involved.

We would not exclude the Army from the field of selection, but unless a man can be discovered there who is equipped with a thorough knowledge of the branches to be taught, who has had experience in teaching, and who is known to possess those qualities of mind necessary to the successful instruction of youth, we recommend that the President look beyond the Army for a man to succeed Professor Andrews when that officer retires from active service. There may have been reasons in former years for selecting all the professors for the Military Academy from the Army. There surely can be no reason now for continuing that policy. In addition to the manifest propriety

of such a selection as herein advocated, we believe that the best interests of the Academy and of the Army would be promoted by adding to the Academic Board learned men from civil life, who would bring to that body the ideas and methods prevalent in the leading colleges of the country, whenever this can be done without trenching upon those departments that have strict relation to the science of war.

The Board of Visitors, after careful investigation and reflection, agrees with the opinion expressed by nearly every preceding Board, that the present course of studies should not be increased by the addition of a single page, but we can not resist the conviction that more time should be devoted to the study of the English language. "The officer ought to know at least something of French and Spanish" says the report of the Board of Visitors for 1889, "but if either or both of these tongues are to compete with English we unhesitatingly give our preference to the last. We do not think they need to conflict. In speech the Frenchman and the Spaniard are coming to us far more rapidly than we can go to them. It is argued that the Spaniard is our neighbor, but it would seem that we are also his neighbors. It has been argued also that an officer once owed his life to the fact that he understood the language of his Spanish captors. The same might be true with respect to any of the once formidable Indian dialects. We are inclined to suggest as to the Latin that it is the mother of the Spanish, the French, the Italian, and the Portuguese, as well as the resistless key to the technical terms, and to the specific nomenclatures which are the shorthand of science and are as obscure to the non-Latin scholar as they are clear to him who unlocks their simple secrets. In addition to all this the Latin is one of the keys to English, and the general many-sided arguments thus hinted with respect to the Latin language need not turn its back to the foes of the study of that and other dead languages. Though dead, it yet speaketh, and is mighty to open dumb mouths, whether in French, Spanish, or English. Retain the French and the Spanish, but not at the expense of the English."

THE STUDY OF SPANISH.

In the discussion of the curriculum of the Academy the attention of the Board was specially directed to the study of the Spanish language by reason of the fact that a member of the first class was pronounced deficient in that study. The Spanish language is taught only during the fourth or last year of the course, and is embraced in sixty lessons. It seemed to the Board that a young man who had been successful in all other studies should not be deprived of a diploma because he failed to reach a prescribed mark in a branch which is regarded as of so little consequence by the Academic Board that its study is limited to a few months at the end of the term, and its value in the course expressed by 75 in a total of 2,300, which is the maximum value of the four years rse at the Academy. The deficient in this case was given a second

examination in August, which he passed with credit, and was sent out with the diploma of the institution and the usual recommendation for appointment to the grade of second lieutenant in the Army.

We are not prepared to say that the study of Spanish at the Academy should be eliminated from the course, but unless more attention be given that study it would seem that the time thus consumed might be advantageously devoted to either English or French. Whether the study of Spanish as prescribed at the Academy is profitable is a debatable question and one upon which opinion among army officers is divided. Colonel Thayer, in the paper quoted in this report, recommended that "the Spanish language be stricken from the regular course of studies and taught only as a voluntary study to such cadets as, in the opinion of the Academic Board, are capable from previous acquirements of pursuing the study without detriment in their progress in the obligatory studies." This would be better than the present plan, for the reason that under it some cadets would learn Spanish while now none do. It is not contended that the amount of Spanish acquired in the six months it is taught at the Academy has no real value, but it is believed that the limited elementary knowledge thus acquired does not wholly compensate for the time consumed in a course of studies that is already overcrowded.

It is doubtful whether any graduate ever left the Academy who could carry on a colloquy in Spanish as the result of the teaching at the institution. Officers of the Army have acquired a speaking knowledge of Spanish by contact with it while serving on the Mexican frontier, and among those Indians in the southwestern Territories by whom the language is spoken. But this is true of officers who were not educated at the Military Academy. We believe that a speaking knowledge of the Spanish language, or such knowledge as would enable the graduate to readily become proficient in that language after leaving the Academy, would be important and valuable, and particularly at the present time, when we are about to assume more intimate relations with our Spanish-speaking neighbors, and therefore recommend that greater time and attention be given it; but if this can not be done, that it be stricken from the course of studies and taught only as a voluntary study, as recommended by Colonel Thayer.

In this connection the Board specially directs attention to the fact that none of the instructors in the Department of Modern Languages have a speaking knowledge of either French or Spanish, the two modern languages taught at the Academy. The ability to speak these languages does not seem to be regarded as essential in an instructor at West Point. The French language is studied during the second half of the first and all of the second year at the Academy, the purpose being to enable its graduates to read and translate French into English. "No more time should be bestowed upon it (the French language) at West Point," said Colonel Thayer, "than would enable

the pupil to read French with facility and without the help of a dictionary." Hence it is perhaps that little, if any, inquiry is made as to the extent of linguistic knowledge possessed when an officer is detailed as assistant professor or assistant instructor of modern languages at West Point.

The present head of this department, Prof. George L. Andrews, is efficient, painstaking, and enthusiastic in the administration of his department, and has labored faithfully for its advancement. Upon invitation of the Board, Professor Andrews attended one of its sessions and discussed the affairs of his depatrment. He believes, and several of us agree with him, that too much time has been absorbed by the mathematical branches at the expense and to the detriment of the others, and that steps should be taken to revise the course of studies by a competent commission with a view of alloting to each department of study a more equitable portion of time than is now allotted. The Board believes that there is urgent need for a revision of the course of studies and for the establishment of a permanent supervisory authority, independent of the Academic Board, to regulate the studies from time to time in some manner similar to that proposed in the report of Colonel Thayer. We agree with Professor Andrews that no Board of Visitors, in their very limited time, can give proper consideration to the important questions involved in a change of studies, and therefore recommend that a commission be appointed for that purpose to be composed of experienced educators of acknowledged learning and ability, of whom not more than two should be graduates of the Military Academy on the active list of the Army, other than professors of that institution.

VIEWS OF PROF. GEORGE L. ANDREWS.

At the request of the secretary, Prof. George L. Andrews prepared the following letter as the substance of the views presented by him verbally before the Board of Visitors:

U. S. MILITARY ACADEMY,
West Point, N. Y., July 27, 1891.

Maj. JOHN M. CARSON,
Secretary of the Board of Visitors, Washington, D. C.:

DEAR SIR: In compliance with the request in your letter of July 20, I make in brief the following statement of my views respecting the propriety of making changes in the present course of studies at the Academy, a statement embodying the substance of what I said, on the occasion to which you refer, in reply to questions from members of the Board of Visitors.

It should seem that a fair amount of liberal culture is a necessary preliminary to the proper study of the military profession. And it is to be considered that most candidates for admission to the Academy are not well qualified to enter even an ordinary high school. What the law requires for admission is wholly insufficient to secure satisfactory attainments on their part. There are admitted some who have not been at school for years. The year between appointment and admission is too short a time in which to make up considerable deficiencies, and is mostly employed in cramming for examination. Under the present system of selection and appointment, with

the prevalent opinion respecting poor districts and poor boys, it is not probable that there will be at present much improvement in the qualifications of average candidates. Hence the course of studies at the Academy cannot be wholly or even mainly professional, and the Academy must have much the same function as the college; professional studies being pursued mostly in post-graduate schools and in the profession itself. In this respect the post-graduate schools of the Army now furnish facilities not formerly offered, though much needed. Moreover, the course at the Academy must be shaped with due regard to the attainments of persons admitted.

Most candidates have little knowledge of English, and no knowledge of any other language. In view of this fact, and of the amount of linguistic study usually regarded as necessary in even a fairly liberal education, it seems to me that the present proportion of that study at the Academy is by no means too large, and should be increased rather than diminished. As a disciplinary study, and as a most valuable aid to the proper study of English, Latin, when commenced at a sufficiently early age and pursued sufficiently far, is in my opinion preferable to any other foreign language. But at the age at which candidates are admitted, with their very inferior attainments, with no previous study of Latin, their linguistic training will best be through the study of modern languages, which are less difficult and require less time, while they are of greater direct utility. In respect of disciplinary and literary value, I think the best two foreign modern languages are French and German. Of these two, for the course at the Academy, I prefer French, as less difficult, requiring less time for satisfactory attainment, of about equal literary and professional value, and of more general utility. The proper study of both these languages would, in my opinion, require more time than could reasonably be allotted to the study of foreign languages at the Academy. Spanish is probably the least difficult of modern languages, yet differs in construction from English so much as to be valuable as a disciplinary study, especially to average cadets. Considering our long Mexican frontier and the increasing intercourse with Spanish-American countries, a knowledge of Spanish is of direct practical utility to the officer of the Army. In the military schools of France the study of German, and in the military schools of Germany the study of French, form an important part of the course. It is probable that two foreign languages will continue to form part of the course at the Academy, and under all the circumstances the two should in my opinion be French and Spanish. The time allotted to Spanish should be increased, so as to restore the former number of lessons, 112, instead of the present 60.

I think that the time given to English might be increased by the time now given to French the first year, about 60 lessons; leaving French to be studied only the second year. This would give to English 185 lessons instead of 125; and to French, 222 lessons instead of 282. And in teaching any foreign language at the Academy, a prominent object should be to enable the cadet to understand English more perfectly, and to use it with greater freedom. Battling with the difficulties and peculiarities of other languages, and especially with the difficulties of correct idiomatic translation, is one of the best aids to a mastery of our own language.

I would also suggest that the consideration that can be given to changes in the course of studies at the Academy by a Board of Visitors in their very limited time, and especially a consideration of changes in only one department of instruction, is quite insufficient. And, in my judgment, before any such changes are made, the whole subject of the course of studies at the Academy should be referred to a well selected, competent commission, for full consideration and for recommendation of such changes as may be found expedient. The commission should be specially appointed for the purpose, should be composed of persons well qualified to judge of the relative value and due proportion of studies, and should include two or more graduates of the Academy, selected so as to represent the different views in respect to the present course. For obvious reasons, the Academic Board is not adapted to the impartial, dispassionate consideration of the subject; but its members should be fully

heard by the commission. It is to be hoped that the commission would not, like the commission of 1860, be content with eliciting mere assertions or expressions of opinion on the part of persons called before it, but would inquire into the grounds on which such assertions or opinions were based. There has never been such a full consideration and discussion of this important matter as is here contemplated, and it should seem that the time for it had fully come. Whether the studies of the present course are in due proportion, and whether part of the time now given to mathematical and professional studies might not better be given to other, perhaps to new branches, are questions well worth considering and deciding.

Very respectfully, yours,

GEO. L. ANDREWS,
Professor of Modern Languages.

HEADQUARTERS U. S. MILITARY ACADEMY,
West Point, N. Y., July 28, 1891.

Respectfully forwarded to Maj. John M. Carson, secretary of Board of Visitors of U. S. Military Academy, Washington, D. C.

WM. F. SPURGIN,
Captain 21st Infantry, Acting Superintendent.

OPINIONS OF EMINENT EDUCATORS.

For the purpose of ascertaining the views of men competent to give testimony on this subject, and whose opinions, based upon actual experience in teaching, as well as their deservedly high reputation as men of learning, would have weight with the Federal authorities and influence with the people, the secretary addressed to a number of gentlemen actively connected with the leading colleges of the country, and with other educational institutions, the following letter:

WASHINGTON, D. C., *September* 15, 1891.

DEAR SIR: At the United States Military Academy, West Point, N. Y., in addition to departments that have close relations to the science of war, there are three—modern languages, drawing and history, geography and ethics—which are not intimately related to that science. The practice has obtained to select officers from the line and staff of the Army to the professorship of modern languages and of drawing. The Board of Visitors for this year believes that these two professorships should be filled by men thoroughly equipped for the discharge of the important duties involved; that such men are not likely to be found in the Army, and that, therefore, the President of the United States should select from civil life well-trained men of known ability for the two places named, when vacancies occur. The Board, therefore, instructed me, as secretary, to present its views on this subject in the report to be made to the Secretary of War and the two Houses of Congress.

The professor of modern languages will be placed on the retired list of the Army in August, 1892, as he will reach the age of 64 at that time. This department consists of one professor, two assistant professors, and three instructors, the assistant professors and instructors being officers of the Army detailed for and continued in this duty for a period of four years. English is taught the first year only, French the last half of the first and all of the second year, Spanish the last half of the fourth year, Spanish being limited to sixty lessons. The professor and assistants have not that acquaintance with French and Spanish required for conversation in those lan-

-es. The Military Academy does not pretend to give its students a speaking ledge of these two languages, but limits its efforts to preparing them to trans- without the aid of dictionaries.

The Board of Visitors believes that the best interests of the Academy demand that the department of modern languages should be reorganized and strengthened, and that at least the professor of that department should have a thorough knowledge of the languages taught. With the view of properly presenting this matter to the President, it is desired to obtain the opinions of gentlemen representing the educational interests of the country. You are respectfully requested, therefore, to furnish a letter for this purpose, briefly giving your opinion as to what steps should be taken on the points stated in this communication, and generally as to what, in your judgment, is required to improve and strengthen the department of modern languages. The report being in course of preparation, an early reply is solicited.

Very respectfully, yours,

JOHN M. CARSON,
Secretary Board Visitors, U. S. Military Academy.

All to whom this letter was sent did not respond; but the number and character of those who did, and the unanimity of sentiment which pervades their letters, will enable the President and the public to see that the recommendation of the Board in relation to the selection of professors at the Military Academy for departments not intimately associated with the teaching of the science of war should no longer be confined to the United States Army. Following are the replies received:

FROM PRESIDENT PEPPER, UNIVERSITY OF PENNSYLVANIA.

UNIVERSITY OF PENNSYLVANIA,
Philadelphia, September 28, 1891.

DEAR SIR: I feel that I can not do better, in replying to your letter of September 15, than to inclose you a note, prepared at my request by W. A. Lamberton, esq., Professor of Greek in the University of Pennsylvania, after an interview in regard to the subject of your query.

Yours, very truly,

WILLIAM PEPPER,
President.

JOHN M. CARSON, Esq.

PROFESSOR LAMBERTON, UNIVERSITY OF PENNSYLVANIA.

UNIVERSITY OF PENNSYLVANIA,
Philadelphia, September 22, 1891.

DEAR DR. PEPPER: Your note inclosing letter of inquiry as to modern languages in West Point only came into my hands this morning, as I had not been at the university for some days. I don't think there can be any doubt the Board of Visitors are right in their feeling that the department of modern languages at West Point should be in perfectly competent hands, *i. e.*, in the hands of men thoroughly equipped for their work. Whether such men are or are not likely to be found in the Army is a matter on which I have no information and so can not speak; but I do think that with a view to getting the right and fittest men there should be no restriction to the Army or any other list in the selection.

The idea of the instruction at the Military Academy seems to me very properly limited to the practical requisition of the two tongues mentioned, their acquisition for use in quite other directions than the linguistic. But I can see no object in limiting the degree of practical utility that is aimed at. It may not be, indeed I hardly think it is, possible to give what would be correctly called a speaking knowledge of

[illegible] circumstances con- [illegible] examined as. You [illegible] conversation, who can [illegible] having recourse [illegible] great majority of [illegible] will be [illegible] their knowledge as far up to, if not [illegible] their knowledge in the way of [illegible] result [illegible] French sentence [illegible] maintained to the end: this will be per- [illegible] because they will have reached a point in the study [illegible] without running a risk of falling back, they are [illegible] knowledge of words and idioms, though the readiness with [illegible] account in independent utterances may diminish [illegible] and secondly the possibility of constant reading is [illegible] at all times.

[illegible] we only want to train the boys so far that they [illegible] without dictionaries. This: It fosters in their minds a low aim, [illegible] they will interpret the words naturally in a lower sense than [illegible] they will mentally if not outspokenly, insert the [illegible] and translate into "just barely so far," etc. That is, their [illegible] aimed at the lowest limit of allowable attainment. This I [illegible] for more reasons than one, chiefly, however, because, to put [illegible] "just barely sufficient" will in innumerable cases prove to be the insufficiently one gets a clear appreciation of the sense of a given passage just in proportion as he possesses a surplus of knowledge beyond what that passage calls for, and, more than this, it in so far habituates the youth to low aims in all and every work. In my view, then, the effort of the Academy should be to bring the student as far forward in the road to speaking the languages as possible; the lower aim will be secured and can only be secured properly by aiming above it.

As to Spanish in particular I have had the impression, gained through conversation with graduates of the Academy, that one main reason for instruction being given in it there lay in the relations of Spanish-America. If that is correct, it surprises me to learn that the aim in the study of that language is set so low and that so little time is given it. And in any case it is one of the languages of our own continent, and it looks more and more every day as if our Government would be the better for, if not have absolute need for, trained servants who possessed it thoroughly. However, I only throw this in as a hint; it goes perhaps beyond the scope of the inquiry.

The head of the Department, of course, should have a thorough knowledge of the languages, and, I would add, of the literature of them; but the subordinates should also have a thorough practical knowledge of them, a speaking knowledge and a grammatical knowledge. It is no paradox, but a mere truism, to say that in teaching the force that does the work comes from the surplus of knowledge that is not conveyed and not at the time to be conveyed to the learner. Here, as in everything else, it is the reserve force that tells and gives effectiveness to the work actually attempted. There will be plenty of room left for the professor's superiority and for the exercise of his wonderful head. Now do I think that there will be any difficulty in finding applicants for the places in abundance who will possess all these requirements in ample measure.

[illegible] who does not know the details of the course at the Academy, [illegible] that course works and is worked. [illegible] and strength- [illegible] bearing the ar- [illegible] I have said that the time assumed [illegible] as far as I can estimate it.

Some means should be devised, perhaps by courses of reading in connection with the more technical department, by which French could be "kept up" or at least kept before the students' minds to the end of the course. And sixty lessons in Spanish reads very much like time thrown away when one recollects the proneness of students to imagine that a whole subject ends and is absolutely determined just where the threads of it are dropped in his course, and, more than this, the readiness with which a subject that must necessarily be left with the loose ends fades out of their minds; one can not but lament such letting drop of French after but a year and a half's study, and of Spanish after such a mere beginning can have been made. Such a limitation of French might be defended were the aims of the study educational and not practical; for the careful work that might have been done would, viewed as a work, not be lost; but, as the aim is a good reading knowledge, it is more than to be feared that, except in one or two extraordinary cases, reading knowledge will have to be acquired again or will be forever lost. For the limitation of Spanish to half a year and sixty lessons I can see no defense on any ground.

At the risk of suggesting what may prove but a complication to the adjustment desired, I would like to ask, what about German? Its importance as a language possessing a valuable scientific literature is now universally acknowledged, and I should imagine its value to the military student could hardly be denied, if for nothing else, for the reason that the remarkable staff reports of such a master of the art of war as Von Moltke are in that language.

As a practical suggestion, covering the whole, it occurs to me that the first step should be the selection of a man thoroughly qualified in the matter of the languages concerned, and endowed with that necessary common sense and adjustability to surrounding circumstances that will enable him to base his course, not merely upon a theoretical view of its aims and needs independently considered, but upon a comprehensive survey of the whole system of which it is to form a part. Such a man of competent knowledge and good judgment could alone and only too after appointment, when he should have had the possibility of studying the situation thoroughly and reporting upon it, offer a plan at once theoretically correct and practically "workable."

In consequence of the delay of the letter in reaching me, I have sat down at once to answer it, and it may be have not either in form or arrangement been able to avoid evidence of haste. My opinions, however, have not been formed hastily.

Very sincerely yours,

W. A. LAMBERTON.

PRESIDENT WARFIELD, LAFAYETTE COLLEGE.

LAFAYETTE COLLEGE,
Easton, Pa., September 16, 1891.

DEAR SIR: Your circular letter of inquiry has just reached me. I am glad to respond to your request, and, having some very close ties with the Army, I have long taken a warm interest in West Point. I shall try to answer your inquiries, though they are difficult to reply to succinctly, as they open up many mooted points.

(1) I prefer to have a department of modern languages directed by an American, especially if English is to be included.

(2) I prefer to have the foreign languages taught by natives of the country where the language is spoken.

(3) I regard German as most important, and have long wondered why it was not added to the curriculum at West Point.

If more than one language is to be taught by a single professor, it should be a cognate, or the instructor should be an American. The once common practice of a German or Frenchman teaching both German and French has much to condemn it. The American mind is usually more facile and freer from linguistic prejudices than is to be found in any foreigner, and the practical purpose of the Military Academy app to an American temperament more strongly than to the slower German and

[illegible] Prof. [illegible] [illegible] [illegible]

PRESIDENT JESSE, UNIVERSITY OF MISSOURI.

UNIVERSITY OF THE STATE OF MISSOURI,
PRESIDENT'S OFFICE,
Columbia, Mo., September 21, 1891.

DEAR SIR: As my opinion has been asked in regard to the teaching of modern languages in the U. S. Military Academy, I take this opportunity of addressing to you my views on the question. Detailed specification is dangerous when offered by those that do not view the ground daily; but I will say freely and emphatically that more English should be taught at the Military Academy than has ever been provided for hitherto. This much I will say unconditionally; and, furthermore, it would take weighty objection to convince me that, in some form, it should not continue through the four years' course. With Latin and Greek wholly omitted, French, German, and Spanish should, in my opinion, be taught; and the instruction should end not in reading alone, but in some aptitude in conversation. I have had much experience, during a residence of thirteen years in New Orleans, in this matter of teaching pupils to speak and understand speech in foreign languages. The result is a firm conviction that all that is necessary is a reasonable amount of time and thorough qualification in the teacher. The chief troubles are (1) the quackery of men who insist that these results can be reached in incredibly short periods of time and without the aid of sharp grammatical study; (2) the utter lack of qualification in the teachers of modern (foreign) languages, in most cases. Great caution is necessary in speaking of these matters by reason of (1) the old fogyism of the (so-called) grammatical method men, and (2) the quackery of many among the (so-called) natural method men. For women—fashionable young women—and children, the natural method is unquestionably best; but for people whose brains have received fair development and fair training a combination of both the grammatical method and also the natural method is the only true way.

I have looked with some care into this matter both in American and also in European schools. As I do not teach modern languages myself, but the classic only, I speak without personal interest in any form. It is necessary to add that serious teaching in English, French, German, and Spanish, superadded to what is already required in the Military Academy, would overcrowd the curriculum, starting where it now does. A raise would be indispensable perhaps in the standard of admission—say a year at least. I believe that professors could be found in many of our American colleges and universities amply qualified to teach modern (foreign) languages seriously. Either some of these civilians should be employed to raise the teaching to the proper plane, or Army officers should have scholarships for study in Europe that they may prepare themselves thoroughly for this work. We schoolmen should never forget that the Military Academy is not designed to be a school of languages or of science, but aims to turn out good officers and military engineers. History proves that it has reached these aims nobly. None of us should also forget how thorough the instruction is within the appointed range. None of us should try to extend the range so far as to destroy the design of the school. But nevertheless, in full view of all of these considerations, I still hold that more time and pains should be given to English, French, German, and Spanish, even though that should necessitate a raising of the standard of admission by a year or a year and a half.

It would be impertinent for me to speak thus candidly, except under direct invitation. I have accepted the invitation and spoken frankly but respectfully. Surely I have had no disrespectful intent towards anything, or any person, or any class of persons; moreover, I have no personal or official interest whatsoever in the matter.

I am, very respectfully, yours,

R. H. JESSE,
President.

JOHN M. CARSON, Esq.,
Secretary Board of Visitors, U. S. Military Academy.

PRESIDENT HYDE, BOWDOIN COLLEGE.

BOWDOIN COLLEGE,
Brunswick, Me., September 26, 1891.

DEAR SIR: In reply to your inquiry of the 24th instant, permit me to express the opinion that the only sound educational policy in the matter of appointments is to secure the best available men in the department which is to be filled, and that proficiency in that department is the main thing, and all other considerations should be secondary and subordinate.

The introduction of two or three men who are alive to the human as distinct from the professional aspects of literature, language, and ethics, would do much to broaden and deepen the training imparted at the Military Academy, and make the cadets at the same time better soldiers and better men.

Very truly, yours,

WM. DEW. HYDE.

Mr. JOHN M. CARSON,
Secretary Board of Visitors, U. S. Military Academy.

PRESIDENT ELIOT, HARVARD UNIVERSITY.

HARVARD UNIVERSITY,
Cambridge, Mass., September 15, 1891.

DEAR SIR: The problem to which your circular of September 15 relates is a difficult one. A civilian professor of modern languages at West Point, with none but Army assistants would, in my opinion, be in an untenable position. On the other hand, if the department were wholly made up of civilians, it might not command the cordial support of the rest of the academic staff.

I should think that the Board of Visitors might wisely confine itself to exhibiting clearly the weakness of the present organization of the department of modern languages, and to calling on the teaching staff of the Academy and the Secretary of War to devise a thorough remedy.

Very truly, yours,

CHARLES W. ELLIOT.

Mr. JOHN M. CARSON,
Secretary.

PRESIDENT WARREN, BOSTON UNIVERSITY.

BOSTON UNIVERSITY, PRESIDENT'S OFFICE,
Boston, September 19, 1891.

MY DEAR SIR: I have the honor to acknowledge your kind communication of September 15. It reaches me, however, at a time when I am so preoccupied with the duties connected with the opening of our different schools and colleges that I feel unable to acquaint myself with all the facts which I should need to investigate in order to make an intelligent and useful recommendation upon the point submitted. I should the more regret it were I not assured that the Board of Visitors and those selected by them include so many able and experienced men that the right decision seems quite sure to be reached.

Yours, very respectfully,

W. F. WARREN.

Mr. JOHN M. CARSON,
617 Fourteenth Street, Washington, D. C.

PRESIDENT HALL, CLARK UNIVERSITY.

CLARK UNIVERSITY,
Worcester, Mass., September 19, 1891.

DEAR SIR: In response to your circular letter of September 15, I have no ... in saying, upon your presentation of the facts, that the chief instructors

in the two departments named should be selected wherever the best knowledge of the subject and teaching ability combined can be found, with no reference to whether such instructors are men trained for military or civil life.

Sincerely yours,

G. STANLY HALL.

Hon. JOHN M. CARSON.

PRESIDENT ANDREWS, BROWN UNIVERSITY.

PRESIDENT'S ROOM, BROWN UNIVERSITY,
Providence, R. I., September 16, 1891.

MY DEAR SIR: It seems to me very clearly desirable that the professor of modern languages at West Point should have a perfect knowledge of German, French, and Italian, at least, and that the course in Spanish should be greatly extended. It is every way proper, and will sometimes be indispensable, for army officers to understand Spanish quite thoroughly. It might be possible to secure a military officer sufficiently well educated to be a suitable professor of modern languages, but it would probably be much easier to secure a civilian for that post.

Very truly, yours,

E. BENJ. ANDREWS,
President.

JOHN M. CARSON.

PRESIDENT ADAMS, CORNELL UNIVERSITY.

PRESIDENT'S ROOM, CORNELL UNIVERSITY,
Ithaca, N. Y., September 24, 1891.

DEAR SIR: In answer to your circular of September 15, I beg to say that, in my opinion, the chair of modern languages at West Point should be occupied by a man who has been specially trained for that purpose. I know not what particular reason there may be for any other course. To a man accustomed to education, the question seems capable of but one answer.

I am very truly, yours,

C. K. ADAMS.

Mr. JOHN M. CARSON,
Secretary Board of Visitors, U. S. Military Academy.

CHANCELLOR SNOW, UNIVERSITY OF KANSAS.

CHANCELLOR'S OFFICE, THE UNIVERSITY OF KANSAS,
Lawrence, September 23, 1891.

DEAR SIR: Your circular latter of the 15th instant is at hand. It goes without saying that the professor of modern languages in the U. S Military Academy should have a thorough knowledge of the languages taught. Instruction in any branch can not be properly given without thorough preparation on the part of the instructors. I therefore sincerely hope that future appointments to the faculty of this Academy may be made upon the basis of the qualifications of the person appointed.

Yours, sincerely,

F. H. SNOW,
Chancellor.

Mr. JOHN M. CARSON,
Secretary Board of Visitors, U. S. Military Academy, Washington, D. C.

PRESIDENT NORTHRUP, UNIVERSITY OF MINNESOTA.

UNIVERSITY OF MINNESOTA, PRESIDENT'S OFFICE,
Minneapolis, Minn., September 19, 1891.

DEAR SIR: It is extremely desirable that students who study French and Spanish should learn to converse in those languages. In no institution does it appear to

more important for the students to learn to converse in those tongues than in West Point. That they may so learn, they should have instructors who are masters of these languages and able to converse in them. If such instructors can be found in the Army, well; but, if they can not, proper persons outside of the Army should be selected as professors and assistants. I do not see that it makes much difference whether the professor of French is a warrior or not.

Very truly, yours,

CYRUS NORTHRUP,
President of University of Minnesota.

JOHN M. CARSON, Esq.

PRESIDENT CHAMBERLIN, UNIVERSITY OF WISCONSIN.

OFFICE OF THE PRESIDENT, UNIVERSITY OF WISCONSIN,
Madison, September 18, 1891.

DEAR SIR: In replying to your inquiry of the 15th instant, I beg leave to express the opinion that the first consideration in filling the professorships you name should be competency, and that, as they are nonmilitary, the filling of the positions should not be constrained by military lines. It would be my judgment, however, that preference should be given to officers of the Army, because I think it wise that they should be employed in such positions, and the reactionary effect of such employment upon the education and intellectual efforts of the officers of the Army would be beneficial.

Very respectfully, yours,

T. C. CHAMBERLIN.

JOHN M. CARSON, Esq.,
Secretary Board of Visitors, U. S. Military Academy, Washington, D. C.

PRESIDENT ANGELL, UNIVERSITY OF MICHIGAN.

UNIVERSITY OF MICHIGAN, PRESIDENT'S OFFICE,
Ann Harbor, October 7, 1891.

DEAR SIR: On my return from Europe I found your letter of September 5. In answer to it I desire to say it seems to me very important that modern languages should be thoroughly taught in the Military Academy at West Point, and especially that Spanish should receive much more attention. Inasmuch as the time and attention of the graduates are largely given to military pursuits, it would seem to me judicious that men accomplished in the modern languages should be taken from civil life to fill the chairs to which you refer.

Yours, truly,

JAMES B. ANGELL,
President.

Mr. JOHN M. CARSON,
Washington, D. C.

PRESIDENT JOHNSTON, TULANE UNIVERSITY OF LOUISIANA.

NEW ORLEANS, *October* 9, 1891.

DEAR SIR: Your letter of September 15 was received by me on my return to this city only a few days ago, hence the delay in my reply.

I request my opinion as to the proper instruction in modern languages at West
I attach great importance to these branches, as will be seen by reference to
y required in Tulane University. A competent knowledge of
id German is required of every graduate of our college. French
ach a professor, teaching his mother tongue, and fully qualified,
n in English is divided between two highly accomplished pro-
se professors are of full grade and salary. The languages are

Copyright.

Stoddard, Glens Falls, N. Y.

FENCING AT WILL.

taught in their philogical, literary, and historical aspects, and the students use them *in* the classroom. We give much attention to elocution and essays, and teach literature *in* literature by encouragement of reading the best models. Our catalogue will give you the details.

From your statement of the amount of instruction given at West Point, I must regard it as altogether superficial and inadequate. Language is the vehicle of thought at least, and is necessary for its expression, if not for its proper formulation. A man can not be called educated, in any sense, who has not been taught to read, write, and speak his own mother tongue with force and facility. This is especially the case with officers of the Army and Navy, who are constantly required to act and speak for the governments of the country. It seems to me that a knowledge of French and Spanish is very desirable for our officers; and for our engineers I should regard German as of the utmost importance. A speaking knowledge of French and Spanish are as important to the army officer as a reading knowledge of these languages.

I am, very respectfully, yours,

WILLIAM PRESTON JOHNSTON.

JOHN M. CARSON, ESQ,
Secretary Board of Visitors of U. S. Military Academy.

MILITARY DISCIPLINE AND INSTRUCTION.

The value and efficiency of the discipline that prevails at West Point is illustrated and emphasized by the every-day conduct of the individual cadet, and the thoroughness of the military instruction is attested by the perfection of movement in the corps, whether drilling on the "plain," or going through the ceremonies of parade on the ground set apart for infantry maneuvers. The results obtained by the West Point system of government is highly creditable to the authorities of the Academy. It is inflexible in nature, impartial in administration, and just in execution. The Board freely awards the highest commendation to the Superintendent and his assistants for maintaining the perfect state of discipline found at the Academy. Notwithstanding its severity it is tempered with kindness, and every cadet feels that should there be any mistake made in his "reports" for violation of orders or regulations he can appeal to the Commandant or Superintendent with the certainty of receiving patient hearing and fair treatment. Inquiry among cadets elicited no complaints as to the mode of administering discipline, and the cheerfulness exhibited at all times by them is evidence that they are not suffering from oppression.

OMISSIONS IN THE CAVALRY EXERCISES.

While the corps of cadets is thoroughly instructed in all field movements, certain details are omitted from the scheme of military instruction to which we respectfully direct the attention of the proper authorities. In the school of the soldier, mounted, the cadet receives no instruction in the care of horses. He never sees a horse groomed, and knows nothing about saddling and bridling, unless he obtained such information before entering the Academy. It seems to the Board that instruction on these points is essential. One of the first duties the

young mounted officer is called upon to perform after joining a troop or battery is the supervision of the feeding, grooming, and watering of the horses and the regimental "stables" as regularly as it sounds the "assembly." Yet a man may graduate at West Point and never see a horse groomed or fed, and join his troop with no practical knowledge of how to saddle and bridle a horse. The man charged with the supervision of such work can not intelligently perform his duty if ignorant of the details and manner of performing it. It is true the young officer will learn by actual contact when assigned to a troop or battery how "stables" should be attended to, and will in like manner, from observation, learn how a horse should be saddled and bridled; but this may be said of a number of things taught at West Point, some of which are matters of less consequence to the military service and to the Government than those specifically referred to and not found in the scheme of military instruction. The Board believes that cadets should be given practical instruction in the care of horses; that they should be required to feed and groom horses for a period sufficiently long to enable them to acquire the needed knowledge, and that each cadet should be made to saddle and bridle his own horse when summoned for mounted drill. All this service is now performed by enlisted men of the cavalry detachment stationed at West Point, who also attend to the horses and harness for the light battery drill.

SHORT MARCHES IN SUMMER RECOMMENDED.

During the three summer months the corps is in camp all studies are suspended and the entire time devoted to practical military instruction. We suggest that during this period of encampment the corps be given occasional short marches into the adjacent country, in order that each individual cadet may know from experience what it is to march *en route*. In this connection the Board directs attention to the fact that the corps is not supplied with the equipage needed on the march or in the bivouac by a column of infantry, and that when a cadet leaves the Academy and joins a foot company in the Army he has no knowledge whatever of a knapsack, haversack, or canteen, and no idea of the number, character, or use of the several cooking utensils required by a marching column. In short, the cadet receives no practical instruction in this direction, that being left for acquirement after joining his command. It would not only relieve the monotony of camp life and duty as practiced at West Point, if the corps of cadets, with knapsacks packed and slung, haversacks and canteens suspended in the regulation fashion, should be made to perform a number of short marches into the adjacent country during the summer months, but these future officers would in this manner gain knowledge which would be invaluable, and the possession of which would enable them to appreciate the amount of labor performed and discomfort endured by enlisted men when on the march.

Further than this, having this kind of knowledge, the more valuable

because acquired by experience, these future officers would know how to lighten the burdens of the soldier on the march, and how to make him comparatively comfortable in camp.

PRACTICAL INSTRUCTION VALUABLE TO CADETS.

While as a general rule it is true that much of the experience of life is acquired by the young officer after he receives his commission and enters upon active duty with troops, it is nevertheless a matter of importance that, pending his course of instruction at the Military Academy, he should acquire some practical knowledge of men and things, since all that comes to him of this nature during his military minority must prove of great value and utility. Discipline requires that the enlisted man shall be largely dependent in thought and action upon his immediate commanding officer, no matter what may be the disparity between them in age and experience. Therefore whatever instruction may be had at the Military Academy calculated to give the cadet an insight into the methods of advising and encouraging the enlisted man, tends to elevate the service by enhancing the confidence of troops in the wisdom, good intent, and personal and military merit of the officers under whom they serve.

In the discussion of this idea, General Philip H. Sheridan remarked to the writer of this report: "Show me a good captain and I will show you a good company. Good companies make good regiments; good regiments make good brigades." General Sheridan looked to the proper government and care of the enlisted man as the paramount essential in bringing troops to the highest order of perfection, and if the captain or commanding officer of the company were lacking in soldierly qualities, caring little or nothing for the comfort and discipline of the men, he knew that the company would fall below the proper standard of merit and usefulness.

REPORT OF THE COMMITTEE.

Following is the report of the committee on Discipline and Instruction, which was unanimously approved by the Board:

ROOMS OF THE BOARD OF VISITORS,
West Point, N. Y., June 6, 1891.

To the Board of Visitors:

The committee on Discipline and Instruction respectfully submit the following report:

(1) *Discipline.*—Discipline has the first place in the report of your committee, because upon its perfection depends all other excellence. If such is its importance, a clear definition is essential; and we must ask, What is discipline? It is such a treatment of the cadet as is suitable to make him a disciple or follower of the great military commanders who have preceded him and won glory and renown for themselves and for our country.

It accomplishes its purposes by training to act in accordance with rules. Hence our inquiry involves three questions: (1) What are the regulations of this Academy? (2) What is the character of the officers who administer these rules? (3) What are the results of their administration?

Of the regulations we can say that they deserve our profound respect, for they are the results of nearly a century's experience. They have constituted the rules of conduct that formed the characters of the great men who have graduated here. They have been adopted by military schools in all our States, and have influenced to a great or less extent the administration of many civil colleges. They are now more nearly perfect than ever before, because they provide for their own improvement. Judicious changes have been made all along their history, whenever experience clearly demonstrated the advantages of modifications.

The aim of these regulations is to train and develop the cadet's physical, moral, and intellectual nature. They treat his body so as to preserve its health, to develop its strength, to increase its power and activity, and to make it capable of such endurance as to undergo the great hardships the military service of the country demands. And his moral nature receives no less attention. The cadet is required to consider "duty the noblest word in the language." He is trained to eradicate selfishness from his character.

Such is the theory of discipline as seen in the laws of the Academy; but as laws are not practically valuable unless wisely and efficiently administered, we have inquired into the character and fidelity of the Superintendent, of the professors, and of the instructors. Personal intercourse with them, attendance upon their examinations, and inquiry into their methods of instruction satisfy your committee that they are thoroughly competent, painstaking, accurate, and faithful, and are fair in all their dealings. While they are firm in the discharge of duty and demand that every cadet shall reach the standard required, they are also exceedingly kind in spirit and in manner. They are soldiers and gentlemen, worthy of the imitation of the cadets under their charge. It is a wise provision of the regulations that the professors are to remain permanently at the Academy; and much will be gained by the school if the present Superintendent be kept here many years, for he undoubtedly possesses elements of administrative ability—kindness, firmness, tact, and magnetism—that are not easily duplicated; and the Academy should have the benefit of his character and his work for as long a time as practicable.

The vitality and virtue of any organism may be accurately judged by its power to perpetuate and reproduce itself. Judging by this standard of self-perpetuation and reproductive power, we see here the best evidence of the efficiency of the regulations, in the fact that under their method of filling vacancies the Academy is kept supplied with such a corps of officers as these we now find here.

We may further test the discipline and the officers by inquiring as to the product of their work. What is the outcome of all this expenditure of time and money? In answer to this question many schools might single out a few of their graduates who have attained eminence; and cite these as evidence of virtue in their methods. But this is an unsound argument; for a few such men can be made by self-application of their own native powers. An answer better than this can be given by the United States Military Academy—can be given here where the impress of the regulations and the skill and fidelity of the professors are indelibly marked on every cadet—has he been here six months or four years.

These officers seem to have in their minds the true conception of a great soldier—unselfish, courageous, truthful, accurate, bright, and manly—and out of the rough material given them they fashion the man into whose keeping the welfare, happiness, and safety of the nation may be intrusted. And like Michael Angelo, out of a they make an angel.

on the matter of discipline we conclude: That the rules of the school, con- abstract—their aims and methods; that the professors and officers now —their character, scholarship, skill, and fidelity; that the results of the

regulations as administered—shown in physical, moral, and mental development of the cadet—all deserve the commendation of the Board of Visitors. Our Government and our people are to be congratulated, and they should be encouraged to maintain these laws and to support the administration of the Academy.

2. *Instruction.*—On the subject of instruction we may say that education is the impartation of knowledge in such a way as to give power to hold it, power to use it, power to communicate it, power to get other knowledge more easily and more rapidly. Hence two important elements are involved: (1) Knowledge getting; (2) power getting.

Therefore, to judge of theinstruction given here, we must consider the curriculum and the methods of teaching. To judge of the curriculum we must be guided, not by standards of civil education, which prepare men for the pursuits of peace, but by military standards, which have reference to the arts of war. The adverse criticisms which have sometimes been made on this course of studies are, we think, due to looking at it from the civil standpoint, which is a wrong one, and if followed would militate against the usefulness of the Academy in its preparation of men for the Army.

We find the course of studies dual in nature—academic and professional—one part intended for mental discipline, and the other part for the practical duties of camp and field. Thus there is combined in one school and in one course of 4 years an amount of work such as does not obtain in any other institution. Those who criticise the Academy adversely, fail to consider the herculean task undertaken here and the short time allowed for its performance. The day may come in the history of the country when two separate institutions shall be given to this work and more time be allowed; or when the academic or fundamental training shall be thrown back upon the colleges of the country and this school occupy itself only with such studies as pertain to the profession of arms. But that day has not yet come; and until it does we must appreciate the amount of work that is done at the Academy and the results obtained in the short time allowed.

In the academic department we find:

1. An extensive course of pure mathematics.
2. An extensive course of natural and experimental philosophy.
3. A full course of chemistry, mineralogy, and geology.
4. A course of drawing of unusual excellence.
5. A course of three modern languages, one being English.
6. A department of history, geography, and ethics.

In the department of professional education we find:

1. Extensive courses of civil and military engineering.
2. Practical and theoretical courses in tactics—infantry, artillery, and cavalry.
3. Full course of ordnance and gunnery.
4. Full course of practical military engineering.
5. A department of law.

The standard for admission shows that the candidate is taken in and begins his course, knowing only arithmetic, English grammar, geography, and United States history. How one with such limited preparation can, in four short years, master such courses of general and professional education, is explained only when we consider the nature of the discipline and the fidelity of the professors.

But to comprehend fully all the results the characteristic method of military training must also be taken into account. Much is said in these modern times as to methods of education. Normal schools and colleges are established in all the States to teach methods; institutes are held throughout the country for the purpose of diffusing a knowledge of methods. But it may be apprehended that the true and logical meaning of the word "method" has been lost sight of, and the idea involved in the word "plan" has been substituted; for these so-called methods seem in many cases to be only plans, and are as if one teacher has his plan of piling sticks of wood and other teachers have theirs.

As we all know, there are but two logical methods of thought—the inductive and the deductive. When combined in the order named, they make the complete method. The skillful teacher uses these separately or combined, and in such order as bests suits the subject to be taught and the pupils to be instructed. The soldier's method. of teaching tactics is more nearly perfect than any other; for the wealth, power, and existence of nations depend upon tactical skill; and this skill depends on the methods and results of tactical education. By analyzing this tactical method, the professors in the Military Academy comprehend the model upon which all their departments are best formed. What are these elements of tactical instruction? The answer is exhibited daily on the drill ground. First, while the recruit is paying strict attention, the officer in his own person takes the position of the soldier or performs a movement with as much accuracy as possible, and then describes orally that position or movement. Second, the recruit is made to imitate the position or perform the movement as it has been represented in the person of the officer. Thus far the thought and the work are by the inductive method. The pupil observes carefully, comprehends the facts, and draws in his mind the rule of action. Finally, he is made to execute, with many repetitions and under varying circumstances, similar positions and movements. This is deductive, and serves to broaden and make permanent in his mind the law and the application of the exercise.

Taken all together the method is complete and perfect, proceeding from the fact to the law, and from the law to its application. Every position of the soldier and all evolutions of the company and battalion are taught in this thorough manner. The result is, that besides learning tactics the cadet has established in his mind the best possible habit of thought; and this habit of thought makes him practical and rational in all departments; and when he comes to be a professor here in any branch of education, having been trained in this complete method, it is natural for him to use it in the class room; hence we find the spirit of this method throughout the Academy.

If we consider this method of teaching in its connection with the peculiar discipline of the school as administered by these faithful and efficient officers, we have a full explanation of the fact that at this Academy so much is learned in so short a time, and all is done in such a masterly way.

Recommendations.—Before concluding this report we make the following recommendations:

(1) That the Academic Board shall at the proper time readjust the departments of study in such a manner as to give more time to the English language and greater attention to its literature.

(2) That appropriations be made to increase the apparatus so as to equip every department fully and enable the professors to reach the minds of their pupils by object lessons.

(3) We recommend that the instructor of the band be given the rank and pay of second lieutenant of infantry.

(4) That the membership of the band be raised to forty, 16 of whom to be in the first class and 24 to be in the second class.

(5) That enlisted men intended for field musicians be placed under the tuition of this professor of music for at least one year, so as to secure uniformity in field music throughout the Army.

In conclusion, we would suggest that no better service can be rendered our people than to make them acquainted with the superior character of the discipline of the United States Military Academy, with the excellence of its officers, with the thoroughness of their work, and with the high moral tone that pervades the entire school.

J. T. MURFEE,
FRANK A. O'BRIEN,
THEODORE S. PECK,
Committee.

ARTILLERY—IN BATTERY, PREPARED FOR ACTION.

ARMAMENT AND EQUIPMENT.

Committee on Armament and Equipment.—Messrs. THEODORE S. PECK, CHARLES F. MANDERSON, and JAMES A. WAYMIRE.

THE ARTILLERY BRANCH.

Every report made by the Board of Visitors for several years past has directed the attention of the authorities to the utter lack of proper arms and equipment at the Academy for instruction in field exercises, and earnest appeals have been made in these reports for improvement in this direction. This constant iteration has at last attracted attention and has resulted in securing within the last year a battery of six 3.2-inch steel breech-loading guns. With this exception the armament of the Academy consists of a lot of antiquated guns that should be sent to a museum of ordnance antiquities or utilized by being planted perpendicularly in the earth to the trunnions, to protect the grounds against trespass. Many of the guns are so weak that they can not be used for purposes of instruction, investigation having demonstrated that to fire them would be to endanger the lives of the cadets engaged as well as those of the bystanders who might be watching the drill. Their use, therefore, has been prudently discontinued, and this fact, known to the authorities at Washington through the last two reports of the Superintendent and the report of the last Board of Visitors, does not seem to have disturbed the serenity that prevails at the War Department, nor to have attracted sufficient attention to gain even a passing notice. Colonel Wilson, the Superintendent, in his annual report for 1889, directed attention to the bursting of one of the 30-pounder Parrott guns in April of that year, "whereby the lives of a number of cadets were endangered. Orders have been given," sententiously added the Superintendent, "that the guns of this battery shall not be again fired."

The artillery equipment of the Academy is thus catalogued:

A battery of seacoast guns, of which the cadets use two 15-inch smooth-bore guns, three 8-inch rifles (muzzle-loading), and one 13-inch (muzzle-loading) smooth-bore mortar.

A battery of six 30-pounder muzzle-loading rifles (Parrotts).

A battery of six siege mortars, three 8-inch and three 10-inch.

One battery of six 3-inch muzzle-loading rifles, used and partially equipped as a mounted battery.

One field battery of six 3-inch muzzle-loading rifles.

One battery of six 12-pounder (Napoleon) guns.

One battery of six 3.2-inch breech-loading steel rifles.

This is a formidable array of guns—on paper. To the educated soldier, however, this armament appears ridiculous in repose and would present no terrors in action. The mortality from the use of such guns would be greater in their rear than in their front. Except the battery of 3.2-inch breech-loading steel rifles mounted on steel carriages, which was lately supplied, the guns above described are obsolete and many of them worthless for purposes of instruction. The old muzzle-loading field batteries should be retired from active service, used only for firing salutes, and replaced by guns similar to those in the field battery recently supplied.

In the seacoast battery no two guns are mounted on the same kind of carriage, each carriage doubtless representing a different epoch in the manufacture of gun-carriages. This might be called a "polyglot battery." With such an outfit there can not be any uniformity, efficiency, or satisfaction in the instruction. Lieutenant Hoskins, the senior instructor of artillery tactics, an enthusiastic and accomplished officer, said of these carriages that they "would be appropriately placed if under a case in the Ordnance Museum." The Ordnance Department may properly urge that modern guns can not be furnished the Academy until money and time can be secured to fabricate them; but this plea will not hold good in the case of this collection of diversified and antiquated carriages. The "cranes" are as variegated as the carriages and in strict keeping with them.

In his report for 1890 Superintendent Wilson complains that "the condition of the siege battery is much worse than that of the seacoast battery." Following the bursting of one of the guns of this battery the Ordnance Department, in October, 1889, condemned the battery and replaced it with a battery of 4½-inch rifled guns. In making this exchange the Government, having no modern guns of the required caliber, the Ordnance Department discovered another miscellaneous lot of antiquated and worn-out guns, and these are now in position at the Academy. Having a proper regard for the lives of the young men who would be required to work these guns, as well as consideration for the safety of the innocent people who are usually attracted by the firing, Colonel Wilson called for a history of these engines of double-ended destruction, and was informed by the Ordnance Department that it was "unknown." They had been "selected as the best of a lot on hand at the New York Arsenal, sent there from Washington some years before." These guns were used during the war of the rebellion, to what extent can not be ascertained, but it was known that "some guns of this pattern [illegible]ly burst."

[illegible]it fixed by science and experience to the life of a gun, [illegible]us to use it beyond that limit. These guns have evi[illegible]l to that limit, perhaps beyond it. With a full appre-

ciation of his responsibility for the lives of those committed to his charge and having no faith in the old West Point tradition that "You can't kill a cadet," Colonel Wilson directed that the guns should not be fired at drill.

Until the Government can supply the Academy with modern guns to take the place of the antiquities now in position in the seacoast and siege batteries, we recommend that these two worse than useless batteries be dismantled, and that wooden guns, fashioned after the latest approved models and furnished with modern carriages and cranes, be mounted in their stead. Such a course would not avert the ridicule to which the United States is now justly subjected by maintaining obsolete armament in these two batteries for the instruction of future officers of its Army, but it would furnish evidence that our military men are cognizant of the fact that progress has been made in the fabrication of great guns and that they fully appreciate the importance and value of the improvements. In addition to this, wooden models of modern fashion would at least give the cadets an idea of the kind of guns likely to be used in warfare and of the methods employed in serving them.

MAXIM AND HOTCHKISS GUNS.

We recommend that a Maxim machine gun and a Hotchkiss rapid-fire gun be provided. Both these guns are now generally used in the armies of Europe. It is estimated that the sum of $5,000 would procure one each of these guns complete with a supply of ammunition for target practice. The Government should certainly furnish the Military Academy with at least one each of these modern guns. Capt. Henry Metcalf, of the Ordnance Department, instructor of ordnance and gunnery, thus describes these two guns:

> The Maxim is a gun of American invention, made in England for want of a market here and capable of firing automatically at the rate of eleven shots a second. It uses musket ammunition. Once discharged by the trigger it continues as long as the ammunition chest is filled, so that the gunner can play it like a hose. It has many great ballistic and tactical advantages and promises to supplant entirely the famous Gatling gun. I consider it the most important invention in firearms within the last 20 years. This at the present rate of progress means a good deal.
>
> The other gun, the Hotchkiss rapid-fire gun, is a cannon varying from 1 to 33 pounder caliber, which uses ammunition like that employed in small arms, but of enormous size. The largest cartridge shells are about 4 feet long. It can be fired by hand at the rate of from twenty-five to ten rounds per minute, the rapidity in this case depending mainly upon the use of the peculiar ammunition. This gun, also an American invention, made, for the same reasons as the Maxim, in a foreign country, has almost revolutionized the construction of a large class of foreign fleets. It is eminently adapted to the transformation of a mercantile marine, and in the event of a foreign war would have an important part to play both on shore and afloat.

NEED OF AN ARTILLERY DETACHMENT.

We recommend that a body of artillery soldiers sufficient in number to serve the light battery, detailed from the Army or enlisted for the purpose, preferably the latter, be assigned to the Academy. There are

[illegible] and cavalry for the instruction of the cadets in each of those branches, and a similar force should be furnished for each cavalry company. This is urgently necessary, and the necessity for it has been frequently set forth in official reports from the Academy. The cavalry detachment in addition to [illegible] required to perform duty with the light battery as [illegible]. In order to improve the cadet artillery department it has been urged that a [illegible] battery, detailed from one of the artillery regiments of the line, should be stationed at West Point, in order that the cadets might witness the evolutions of a well-drilled field battery as [illegible] have at hand a well-equipped battery which could be used by them. We do not believe it would be advantageous to the Academy to station a regular light battery at West Point. On the one hand, such a battery would be accompanied by a full complement of officers, for whom suitable quarters would have to be provided, and, as the number of habitable dwellings is now inadequate to the necessities of the post, houses would have to be erected for the officers of the light battery. Being an independent command, barracks for the men and stables for the horses would have to be provided. In addition to this, many difficulties and annoyances would be constantly arising growing out of the anomalous situation of having a battery of guns divided in practical ownership and subject to the call of the commandant of cadets and the commanding officer of the battery. And it should not be overlooked, in this connection, that the officers serving with our light batteries are themselves under instruction and assigned to light batteries specially for this purpose.

On the other hand, to supply the artillery branch with the necessary horses and men preserves the autonomy of the artillery of the Academy, promotes its efficiency as one of the educational branches, makes it what it should be as a cadet battery, and saves the expense which would be involved in providing accommodations for a light battery from the Army.

THE CAVALRY BRANCH.

The deficiency in the cavalry branch of the tactical department is not so serious nor so discreditable as in the artillery, but is sufficiently obvious as to demand early correction. As in the case of the artillery, the Superintendent of the Academy and former Boards of Visitors have for several years regularly directed attention to this matter. Nothing can be added to what has been urged by our predecessors calculated to give greater weight to the importance and urgent necessity of supplying the Academy with a sufficient number of horses to meet the requirements of both cavalry and artillery instruction. The stud of the Academy consists of about eighty horses. These are purchased principally for cavalry exercises, but are used as draft animals also.

This double service destroys the horses for efficiency in either branch, and seriously interferes with instruction in both. Horses should be purchased and kept for the exclusive use of the artillery teams, so that those for the cavalry could be brought to and maintained at a high state of training for riding and for all mounted exercises and drills. About fifty additional horses would be sufficient to do this. The original expenditure necessary would be comparatively small. The resulting advantages to the Academy and the Army would be beyond all proportion to the outlay. Two years ago Capt. J. H. Dorst, of the Fourth United States Cavalry, then senior instructor in cavalry tactics, in directing attention to this matter, said:

The cavalry branch of the Army has been making rapid improvements recently in the methods of instruction, and more improvements are certain to come. In one respect they will be based on much higher training of the horse. Instead of using him merely as a means of transportation, he will be taught to be far more docile and obedient to the rider, when ridden either alone or in ranks. The higher the training of the horse as a saddle animal, the more and more does he become unfit for draft purposes, and the more are his usefulness and docility as a saddle horse impaired by using him for draft. The instruction here should at least be kept abreast of that in the service, but if no change is made the instruction in the service will soon surpass that at West Point. Orders have already been issued from the War Department, reducing the maximum limit of age for cavalry recruits to thirty years, and there is hardly a doubt that in time it will be reduced still more, so as to enlist only men young enough to learn riding readily. In the school of the trooper and riding-hall exercises, the cadets surpass any soldiers in the Army, but with the concentration of troops at large and permanent posts, gymnasiums, and riding schools will be established, and, with limited time for instruction allowed here, it may be more difficult for the cadets to maintain their superiority. The average troop of cavalry can now drill much better in the school of the company than the cadets, for the latter have only three days in the week, during the month of April in each year, for such drill, and that drill is practiced under difficulties, for on the same days the horses are used for artillery drill in the afternoon.

In April, 1888, writing upon the same subject, Captain Dorst said:

Forty-eight horses are required for the artillery teams, and among eighty horses here there is always more or less difficulty in finding forty-eight that will work together, while some nervous and spirited ones are unsafe to work in harness at all. By using the horses alternately for draft and saddle purposes they become unfit for the latter. As an example, upon commencing cavalry drill with the first class last September I was astonished to see how restive, nervous and disobedient the horses were, and could not account for it. They had been used at light-battery drill in August. By the end of September they became tolerably quiet, but in October the battery drill was resumed. I saw the horses made to throw themselves into the collars; charge at speed across the plains; then made to hold back suddenly, while their mouths were sawed to bring them to a halt. As a consequence the mouth that had been made sensitive by delicate handling and quiet treatment was spoiled; an even, quiet gait was replaced by a dancing, unsteady one; nervousness and fretfulness returned, and some horses would seize every opportunity to try to run away. The result of the drilling was not at all satisfactory. It was impossible to obtain the precision and accuracy I have often observed in troops of cavalry with poorer riders and less intelligent men, and it was unsafe to attempt charging by platoon. If cavalry drill on the plain is intended to instruct the cadets to perform drill maneuvers properly, its object can never be fully accomplished while the horses are used for artillery drill.

If it is intended merely as a riding exercise, the cadets might nearly as well be taken to ride along the road. The result of the drill is injurious in some respects, as it gives the cadets a false notion of what a cavalry drill ought to be. Regularly year after year, at the graduating ride, the cadets are ordered to charge across the plain, and regularly do they go to pieces before they have charged twenty yards. They and others look upon it as perfectly natural and proper. It was not till I had been in the service several years that I knew that a cavalry troop could charge in line for a hundred yards or more and then be brought back to a slow gait without a single horse bolting and with comparatively little disorder. And I have even known officers of longer service than mine to express surprise that a battalion of four troops of cavalry should move at a trot with no horse galloping nor cantering. Their ideas of cavalry movements were formed at West Point.

This testimony of Captain Dorst, whose experience at the Academy as instructor in cavalry tactics, and whose extended and varied service in the field with mounted troops make him a thoroughly competent and highly intelligent authority, should be sufficient to convince Congress and the War Department that the public interests require an immediate compliance with the needs which he sets forth. Testimony as strong and as positive as that of Captain Dorst might be added, but this would be merely cumulative. We deem it pertinent, however, in this connection to refer to the views of Lieutenant Hoskins, of the Third United States Artillery, the present senior instructor of artillery tactics at the Academy. In answering certain interrogatories from the Superintendent as to the artillery equipment of the Academy and what was deemed necessary to add to its efficiency, Lieutenant Hoskins, under date of June 6, 1889, wrote as follows on the point now under discussion:

The horses are purchased exclusively with a view to their suitability for cavalry purposes and for the greater part of each year serve as such. For such service they are subjected to a system of training which unfits them for work in harness, and their use in artillery drills undoes all efforts expended to render them efficient as cavalry horses. The variety of uses to which they are put and the number of inexperienced persons to whose handling they are subjected disables many of them, and it frequently happens that the quartermaster has to be applied to for horses sufficient to properly horse the battery. A battery so constituted (a mere makeshift) can never be an efficient means of instruction. For this the personnel, horses, and material must be distinct, and entirely under the administration of the instructor. Men and horses must be thoroughly trained and educated before the point at which the instruction of cadets can begin is reached. For this reason much time is lost, and the season for drill passes without any satisfactory progress having been made in the instruction of the cadet.

BITS, BRIDLES, AND SADDLE CLOTHS.

Attention is directed to what is said by Captain Craig, the present senior instructor in cavalry tactics, touching the supply of bits and saddle blankets. The Ordnance Department limits its supply of bits to two sizes. The effect of this limitation is that instead of adjusting a bit to the mouth of the horse, the horse must adjust his mouth to the bit. This policy saves the Ordnance Department the trouble of a few more sizes of bits to its list of articles furnished mounted

troops, but it entails suffering upon the horses and consequent demoralization to their riders and drivers. The committee by whom this subject was inquired into very correctly say, in their report, that, "as the sizes of horses' mouths vary as much as the sizes of men's feet, there should be more variation in the bit so as better to accommodate the horse." This seems to be one of those things so plainly necessary and so easily accomplished, that we trust the proper authority at the War Department will at once take steps to supply hereafter, not alone the Military Academy, but the mounted service of the entire Army with bits so varied in size as to save the public horses from the torture of a misfit. We also direct attention to what Captain Craig says about furnishing saddle cloths for the cadet troop.

APPEAL FOR THE TROOP AND THE BATTERY.

The Corps of Cadets as a battalion of infantry represents the highest condition of perfection to which that branch of the military service is capable of being carried. The Board believes that the same condition of perfection should be found in the cadet troop and the cadet light battery. Each should be a type and model for the imitation and emulation of the forces of the regular Army and the National Guard. That they are not so is largely chargeable to the neglect of Congress and the indifference of the War Department. Failure to supply modern guns, a sufficient number of horses for cavalry and artillery exercises, proper bits and bridles, suitable saddle cloths and other paraphernalia so essential to the promotion of the efficiency and the *esprit* of a military organization, and especially such a corps as we have at West Point, are the only obstacles to making the United States Corps of Cadets the finest and best trained body of soldiers in the world, and the United States Military Academy the model institution of its class. "We have but one cadet school," said the Board of Visitors for 1889, "and that ought to be as perfect in equipment as is the best in the world. Foreign visitors from every land see our school at West Point, and since we have scarcely a visible army our visitors shape their estimate from what they see at the Military Academy. We know that some officers at the Point maneuver at times to avoid showing the riding gallery and the horses, lest visitors go home to pronounce it all an American cavalry joke. Teachers and cadet riders like those we have seen deserve better surroundings and worthier belongings."

We are confident that this expresses the sentiment of the American people in reference to the Military Academy. No extravagance should be tolerated at this institution, but nothing should be withheld which is needed to make it creditable to the Government and the people. Until the cavalry and artillery departments are supplied with equipments so much needed by them, foreign visitors, of whom we will have an unusually large number the coming two years, are very likely to regard these departments as "an American cavalry joke."

"There is no reason," said Captain Dorst, in one of the papers from which we have made quotations in connection with this particular subject, "why a company of mounted cadets ought not to approximate as closely to a model troop of cavalry in drill, appearance, and neatness as a company of dismounted cadets does to a model company of infantry. Every horse should be so well groomed that when he is brought into the hall his coat would fairly shine; bits and metal work should be kept bright; saddles and straps should be highly polished, and all the appointments of the stable and riding-hall should be consistent with the habits of order and neatness that are imposed upon the cadets as members of the infantry battalion organization of the corps." What is here so well said by Captain Dorst about the cavalry applies with equal force to the artillery.

REPORT OF THE COMMITTEE.

Following is the report of the Committee on Armament and Equipment and the letter of the Senior Instructor of Cavalry Tactics:

ROOMS OF THE BOARD OF VISITORS,
West Point, N. Y., June 9, 1891.

To the Board of Visitors:

The Committee on Armament and Equipment respectfully reports that it has carefully investigated the subjects properly coming within the classification assigned to it, its labors in that direction having been greatly facilitated by Colonel Wilson, Superintendent of the Academy; Captain Metcalfe, Instructor of Ordnance and Gunnery; Captain Craig, of the cavalry, and other officers whose duties bring them into relations with the armament and equipment of the post.

It has been the observation of several previous Boards of Visitors that the horses used by the cadets in cavalry drill and at the riding hall should not be used in the artillery drill. We agree with this suggestion. The reason is obvious to any one at all familiar with horses. It is impossible to make a good saddle horse of an animal that is worked in harness much. The cavalry horses must learn to yield readily to the rein and the bit; to understand the bugle calls; to respond to the spur; to dress in the ranks, and in many ways he becomes a very intelligent machine, requiring delicacy and sensitiveness to sound and touch. The artillery horse, on the other hand, is so fettered by his harness and the burden he draws, is so hardened in the mouth by the rough drill in the battery, and the surroundings are so entirely different from those under the saddle, that he becomes a different machine. In fact, the absurdity of making a horse serve in both capacities is so transparent that it seems a waste of time to offer an argument against it.

In a public institution devoted to the training of military officers there should certainly be no sacrifice of efficiency for the sake of a small economy of this kind. The field battery will require about fifty horses. These could be taken from those now on hand, and in future purchases the best material for cavalry horses could be obtained.

We think the cadets should drill on horseback with the carbine, and also in the skirmish drill on horseback.

There is in use an excellent battery of 3.2-inch field-guns (steel), recently obtained. They are in good condition and afford good material for the instruction of the cadets. But they are the only modern guns, and the only guns at all fit for such purpose.

her similar battery is needed at once. In this connection we call attention to

the last annual report of the Superintendent of the Academy, in which he says (at *page* 7):

"During the short period allowed each year for field-artillery drill, instruction as cannoneers must be given at the same time to both the third and fourth classes, aggregating usually about 150 men. One battery is used for light artillery, the other for foot artillery. At present, in order to keep up the drills, one class must use the old 3-inch muzzle-loading guns, while the other is being instructed with the new 3.2-inch breech-loader. I earnestly recommend that another battery of the 3.2-inch guns be furnished for this post at the earliest practicable day."

In addition to this new battery there should be also a detachment of artillerymen, consisting of two sergeants, two corporals, one blacksmith, and farrier, one trumpeter, and twenty-four privates. Quarters for these men can be arranged for in the new cavalry barracks now under construction, and room can be found for the horses in the present stables, with some minor improvements, which will involve but little expense.

We have already stated that except the new battery mentioned above there are no serviceable guns. In this we are fully sustained by the Superintendent and Lieutenant Hoskins, the instructor in artillery tactics. The former, in his annual report, quotes the latter with approval as follows:

"Lieutenant Hoskins very properly complains of the carriages used in the seacoast battery and the guns of the siege battery. The former he describes as follows:

"'At the seacoast battery the cadets use three 8-inch muzzle-loading rifles (converted 10-inch smoothbore Rodman guns), two 15-inch smoothbore Rodman guns, and one 13-inch mortar.

"'No two pieces of this battery are mounted on carriages of the same pattern, which fact renders a uniform system of instruction impossible.

"'For effective work here guns of the same class should be mounted upon modern carriages, uniform in construction.'

"I cordially concur in the views of Lieutenant Hoskins. It is high time that this important military institution, which annually turns out from 50 to 65 young officers, should be equipped with everything incident to a modern armament."

And then the Superintendent adds:

"The condition of the siege battery is much worse than that of the seacoast battery. During the past few years three guns have burst at this battery, as follows: April 25, 1876, a 4½-inch rifled gun burst at the one hundred and sixty-second round; July 16, 1881, a 30-pounder Parrott gun burst at the two hundred and twenty-second round; April 11, 1889, a 30-pounder Parrott gun burst at the three hundred and twenty-second round.

"Fortunately no cadets were struck by the fragments, although there were some narrow escapes, and in some instances the drums of the ears were more or less injured. After the last explosion the battery of 30-pounder Parrott guns was condemned, and the Ordnance Department, in October, 1889, supplied another battery of old 4½-inch rifled guns.

"Upon calling for the history of these guns I was informed that it was unknown, but that they had been selected as the best of a lot on hand at the New York Arsenal, sent there from the Washington Arsenal some years before. I was further informed that some guns of this pattern had recently burst. An examination of the guns showed that one of them was made in 1861 and the others in 1863, and they evidently had been used during the war of the rebellion.

"By authority of the Secretary of War I directed that the guns should not be fired at drill, as I believed it would be absolutely criminal on my part to endanger unnecessarily the lives of cadets by practicing with these old and obsolete pieces. I earnestly recommend that new 5-inch breech-loading steel guns be furnished for this battery at the earliest practicable moment."

We concur in the foregoing recommendations. We also recommend the purchase of a Maxim gun.

We are aware that heretofore the Government has not been in a position to furnish modern guns, but now that such are being manufactured we feel confident the first issues will be supplied to this post, thereby allowing the cadets the first opportunity to become thoroughly familiar with the most improved ordnance and equipments.

Our attention has been directed to the fact that but two sizes of the bridle bit used by the cadets for the cavalry horses have been furnished. As the sizes of the horses mouths vary as much as the sizes of the men's feet, there should be more variation in the bit so as to better accommodate the horses. In this connection we approve the recommendations of Captain Craig, as shown by the accompanying letter, and also as to the gray saddlecloths.

The senior assistant instructor of ordnance and gunnery is the only officer of corresponding rank at the Academy who is not allowed extra pay. As the detail of a lieutenant for this service increases the cost of living, we recommend that such officer receive captain's pay (the same as others on similar duty) as a means of inviting the best talent to this work.

Respectfully submitted.

THEODORE S. PECK.
CHAS. F. MANDERSON.
JAMES A. WAYMIRE.

LETTER OF CAPT. L. A. CRAIG.

WEST POINT, N. Y., *June* 5, 1891.

SIR: In reply to the verbal inquiries of members of the committee, I have the honor to state that horses, horse equipments, and small arms used for the instruction of cadets in riding and cavalry exercise are satisfactory. It is desirable to gradually obtain if possible a higher grade of horses to be used exclusively for cavalry purposes, as mounts for the first class, as the alternate employment in the troop and light battery makes it difficult to keep the horses in training for either service.

Thirty-five young horses have been received here recently and will give an unusual opportunity for instruction in the very important subject of proper bitting. With this idea in view I have asked the appropriation of a small sum ($120) for the purchase of a few assorted bits to replace the regulation bit during the period of instructions, the latter being heavy and severe for a young horse and the sizes not sufficiently varied.

The appearance of the horse equipments has always been the subject of much unfavorable comment by visitors to the Academy. The Chief of Ordnance of the Army very kindly furnished gray canvas saddlecloth last winter, and, by careful attention to polishing the leather of the saddles and bridles and the brass parts, a decided improvement has been made. The saddlecloths are not of a suitable material to be durable, however, and I have recommended an appropriation of $500 for the purchase of 100 saddlecloths of strong material similar in color to the cadet uniforms, which with ordinary care will last for years and add greatly to the neatness and uniformity of the cadet troop.

Very respectfully, your obedient servant,

L. A. CRAIG,
Captain Sixth Cavalry, U. S. Army,
Senior Assistant Instructor Cavalry Tactics.

Gen. T. S. PECK,
Chairman of Committee on Armament and Equipment of the Board of Visitors.

HEADQUARTERS U. S. CORPS CADETS,
West Point, N. Y., June 8, 1891.

Respectfully forwarded through headquarters U. S. Military Academy. Approved.

H. S. HAWKINS,
Lieutenant-Colonel, Commandant Cadets.

HEADQUARTERS U. S. MILITARY ACADEMY,
West Point, N. Y., June 8, 1891.

Respectfully transmitted to Gen. T. S. Peck, member Board of Visitors.
By order of Colonel Wilson.

J. M. CARSON, JR.,
Second Lieutenant Fifth Cavalry, Adjutant.

BUILDINGS AND GROUNDS.

Committee on Buildings and Grounds.—Messrs. DAVID W. PAYNE, SAML. W. T. LANHANN, and ROBERT O. FULLER.

BUILDINGS IN COURSE OF ERECTION.

During the past few years Congress has been fairly liberal in its appropriations for the buildings and grounds of the Academy. For a number of years, however, prior and subsequent to the war of the rebellion, very little was done in this direction, and this failure to supply the buildings demanded from time to time by the natural increase of the institution, and to take the place of old buildings made inconvenient, uncomfortable, and almost useless by time and the growth of the Academy, resulted in a general running down in these essential requirements. When the buildings now in course of erection are completed the Academy will be housed with comfort; yet much remains to be done in this direction to place it abreast of the leading colleges in the way of buildings.

The new gymnasium is nearly completed and will be prepared for occupation during the current or early in the coming year. The gymnasium of the past was a discredit to the Government. Now that a handsome and commodious building has been erected it is hoped that Congress will provide for a thoroughly equipped gymnasium, and make this department at West Point worthy of this national school.

Upon the close of the academic year operations were at once begun on the academic building, and that old edifice was removed to make room for the new building to be erected on its site. The erection of this building should be pushed to completion at the earliest day practicable.

The cavalry barracks and the hospital for enlisted men, authorized at the first session of the last Congress, are in course of construction. The two sets of quarters for enlisted men, authorized at the same session, will be completed this year. The house erected for the use of the band will also be completed and ready for occupation this year.

QUARTERS FOR ENLISTED MEN.

At the last session of Congress an appropriation of $24,000 was made "for twenty sets of quarters for enlisted men and their families." Those twenty sets are in addition to the ten sets authorized in 1889 red to in the preceding paragraph. With these additions the still be deficient in proper quarters for the enlisted men,

CAVALRY—COLUMN OF PLATOONS.

There are at the north end of the post a lot of shanties which have been occupied for years by the enlisted men. These are a discredit to the Government and a constant menace to the laundry and quartermaster's storehouse, with all the valuable machinery contained in the former and the various valuable stores contained in the latter. No time should be lost in replacing these shanties with brick buildings. This should be done as a measure of economy, even if no consideration be given the enlisted men and their families. Previous Boards of Visitors have directed attention to these so-called "houses" of American soldiers at the only military school supported by the Government. One Board designated them "tumble-down fever-pens." Such houses as these would be discreditable to the Government if found on the frontier. They are a positive disgrace at West Point.

In this connection the Board suggests that regulations should be established to limit the number of married men in the several detachments of enlisted men and those known as "Army service men in the quartermaster's department." It has been stated that the number of women and children constituting the families of the enlisted men largely outnumber the Corps of Cadets, the officers of the Academy and their families, and the entire strength of what may be termed the garrison of West Point. It seems to the Board that the proportion of married enlisted men now at West Point is too large.

QUARTERS FOR JUNIOR OFFICERS.

Additional houses for the use of junior officers on duty at the academy are urgently needed. There seems to be a sufficient number of large houses for the occupation of the professors and officers of higher rank, but many of those occupied by the lieutenants are old, patched-up structures, badly arranged and destitute of proper conveniences. In many of these houses two or more married officers are located. At the last session of Congress $20,000 was appropriated "for two or more sets of officers' quarters." This appropriation should be sufficient to erect four houses in sets of two. When completed a certain measure of relief will be afforded by the additional accommodations thus provided, but there will still be a lack of small houses for the accommodation of the junior officers. The old frame houses at the lower end of the post used for officers' quarters should be removed and plain brick buildings erected in their place.

QUARTERS FOR BACHELOR OFFICERS.

We believe that the comfort of the officers on duty at West Point would be promoted by the erection of a large building for the exclusive use of bachelor officers, the rooms of which should be arranged in sets on the plan of the large "flats" found in the principal cities, and in a manner to supply single men with ample space and proper conveniences. The present domiciliary accommodations are so far below what

is absolutely demanded for personal comfort that, in addition to being crowded into small and incommodious houses, rooms in the cadet barracks are used for quartering officers, the number of rooms now occupied for this purpose, including those occupied by the dentist, being about 30.

Grant Hall, erected as a mess hall for cadets in 1850, is also partially occupied by officers, the north end being used as a domicile and the south end by the officers' mess. The erection of such a building as is here suggested for the use of bachelor officers would furnish all needed accommodations for this class and supply them with apartments which would be commodious, comfortable, and agreeable. The erection of such a building would also enable the married officers to obtain sufficient room in which to make their families comfortable during the four years residence at West Point. A "flat" large enough to accommodate twelve or fifteen bachelors, with a suite of rooms for each, could be erected for a sum about equal to that appropriated by the last Congress for quarters which will not furnish the regulation accommodations for more than six officers.

REPAIRS FOR GRANT HALL.

The floor of the cadet dining room in Grant Hall should be replaced with marble tiles. The tramping of nearly 300 men three times every day on a wooden floor requires that a great deal of scrubbing shall be done. This frequent cleansing results in exhalations that are unpleasant to the highest degree in a dining room. Substitution of stone for wood would not only remove this unpleasant and objectionable odor, but would be the means of saving money. The wooden floor has to be renewed at certain intervals of time, whereas a tile floor would stand for many years. We recommend an appropriation for this purpose.

CADET SINKS AND PUBLIC LATRINES.

A movement should be made at an early day looking to the removal of the building in which are located the cadet sinks and the erection of a building for this purpose at a less prominent point than is now occupied. These sinks are in a stone building south of the barracks, distant about 200 feet, and on the edge of the area used for most of the cadet formations. In stormy weather great discomfort is experienced in going to and returning from this building, and much time is lost by the great distance traveled. The present location will be still more objectionable when the new academic building is completed as the end of that building will be within a few feet of the sinks. It has been suggested that the basement of the cadet barracks could be used for this purpose without detriment to health, as the improvements made in plumbing and drainage are such as to render this change advisable.

Attention is directed to the absence of any latrines and closets for use of temporary visitors to West Point. This has been a subject

of comment by many preceding Boards, and recommendations have been made for supplying such accommodations. Public decency and the preservation of the grounds from defilement, as well as consideration for the numerous visitors attracted to West Point during the summer months, appeal for the immediate erection of such buildings as would secure the purposes referred to. We recommend a specific appropriation for this purpose.

NECESSITY FOR ELECTRIC LIGHT.

We earnestly renew the recommendation made by former Boards of Visitors for the introduction of the electric light. It has been clearly demonstrated that the use of gas as furnished at the Academy is injurious to the eyesight of the cadets. The gas works are not large enough for present requirements, and their capacity will be materially reduced when the new buildings now in course of construction are completed. Lieut. George L. Anderson, of the First Artillery, who investigated this subject in 1889 and submitted plans for lighting the cadet barracks with electricity, in speaking of the inadequacy of the gas works to meet the demand made upon them said:

Although run to their full capacity, the single gasometer is nearly exhausted at 11 p. m. during a great part of the year. In winter a certain number of lights on the streets are often turned off to preserve the supply. The stoppage of a main at any time, or other accident sufficiently serious to interrupt the manufacture for a few hours, would cut short the amount nightly consumed and leave the whole or a portion of the place in darkness. That no inconvenience, due to some slight cause, has occurred within the past three or four years has been owing to good fortune rather than to the excellent management of the works.

The Board sincerely hopes that this matter of furnishing good light for the use of cadets while pursuing their studies will receive prompt and favorable consideration from Congress. The reports of the medical officers for the past few years show a steady increase in the number of cases of treatment for the eyes. Quite a large number of this years' graduating class, more than one-fourth, were found not to have the full requirements as to vision, and in every instance this deficiency was attributed to the insufficiency of the light furnished. In directing attention to this matter the Board of Visitors for 1889 very pertinently said:

The eyes of whole generations of officers of the Army are concerned in this vital issue. A student's eyes are not replaceable like his boots or interchangeable like an officer's weapons. The long periods of darkness in winter in our latitude compel prolonged study, and the priceless sight, which is tested so carefully when the cadet enters the Academy, is apt to be injured through want of better illumination purchasable by a few dollars from the Government, which so recently ordered the ocular tests.

Lieutenant Anderson in the report above referred to made an estimate of the cost for introducing the electric light in the cadet barracks and submitted plans and drawings for this purpose. The cost for light-

ing the barracks was placed by Lieutenant Anderson at $9,540. His report will be found in the report of the Board of Visitors for 1889, page 23. It is unnecessary to insert it in this report, but we reproduce the following paragraphs:

Cadet barracks use one-third of all the gas consumed at the post. The barracks and mess hall together take four-tenths. An electric-light installation would, of course, relieve the present gas plant to this extent. Other considerations relating to the subject are:

(1) The incandescent lamp consumes no air, it does not heat, and it is steadier, safer, and cleaner than gas. The 8-foot gas-burner in each cadet room, 22 by 15 by 10 feet, vitiates about 640 cubic feet of air per hour. It consumes as much good air as eight persons and produces twenty times more heat than the electric lamp. The heat of gas-burners is alleged to be the cause of much headache in the corps.

(2) Complaints of soreness of eyes are made by about a dozen cadets every three months. Out of an average of 255 cadets 28 with eye affections consulted the post surgeon with regard to them during the three months ending January 31, 1887. They are using the argand burner and the best quality of gas, so that improvement may be sought in the direction of another kind of lamp. Owing to the position which may be given it, a 16-candle incandescent light will throw a stronger and steadier light upon a table than an upright gas jet of the same power.

(3) A small electric lamp will probably always be maintained, as at the present time, for lighting the riding hall, and for furnishing electricity to the departments for experimenting purposes. The proposed system can also be readily extended to the library, which is now heated by steam, if it is sought to diminish in this way the chances of loss by fire of a building which is not fire-proof and which contains the most valuable collection of military books and papers in the country.

Considering that the gas works will have to be enlarged in order to meet present requirements, we believe it would be better, from every point of view, to allow the gas works to remain as they are and to put in an electric plant adapted to supplying light to all the departments of the Academy, and which may be so extended as to meet future requirements. An estimate for such a plant, together with plans and details, was submitted to the Superintendent last year by Lieut. John Millis of the Engineer Corps, a well known expert in electricity. This report is herewith appended:

UNITED STATES GENERAL LIGHT-HOUSE DEPOT,
OFFICE OF U. S. LIGHT-HOUSE ENGINEER, THIRD DISTRICT,
Tompkinsville, N. Y., May 31, 1890.

SIR: In compliance with your request, I have the honor to submit the following outline plan, estimates, and specifications for an electric light and power-plant for the U. S. Military Academy at West Point, N. Y.

The plan proposed contemplates a system of electric lighting which, while being adapted to the peculiar conditions now existing, will readily admit of extension as future needs may require; which will eventually, if not at first established, replace all other methods of illumination in the Academy buildings and grounds, and which will also, as a secondary consideration, be adapted to such requirements for the distribution of power as now exist or may arise in the future.

With the above objects in view, the estimates comprise, first, a complete system of electric lamps for cadet barracks and other buildings of the Academy where artificial lights are used, including the academic building, the cadet mess-hall, the library, the chapel, the cadet hospital, the riding hall, the gymnasium, the observatory, and the bath room, sinks, etc.

There are also included electric lamps for the soldiers' barracks, quarters, reading and amusement rooms, and soldiers' hospital; for the officers' mess-hall and quarters, for the quarters of civil employés, for the hotel and headquarters building, for the various shops, storehouses, guard houses, laundries, stables, etc., and for lighting the the Academy grounds and the cadet camp.

The electric plant necessary to operate such a system of lights would, in addition, furnish a very advantageous and economical method of distributing mechanical power by means of electric motors to the various workshops, laboratories, etc., where steam engines or other moters are now employed or where power may be eventually required.

The first considerations are of course the advantages and the adaptability of the proposed system to the requirements of the cadets and to what may be termed the Academy proper. Of the importance to the Corps of Cadets—a selected class of students undergoing training and instruction for the military profession—of the most perfect known method of artificial illumination little need be said, particularly when it is remembered that a greater portion of the study which the exacting course of the Academy requires must be done by artificial light, and that, notwithstanding the rigid examinations regarding eye-sight to which candidates for admission are subjected, failures in the course which are directly attributable to impaired vision are not infrequent. It is now generally conceded that the incandescent lamp is the most perfect known device for interior illumination and particularly for purposes of reading and study. Its great superiority over gas, oil, or other lamps as regards safety from fire, the favorable color of the light, and particularly its freedom from heat and unhealthy products of combustion, are now too well known to require detailed explanation here.

Since the majority of the lamps to be established are for interior illumination, the proposed plant will of course consist mainly of the incandescent system, and the conditions are such as to render the "central-station" plan best adapted to the requirements, as the buildings to be lighted are considerably scattered and there are not sufficient number of large separate buildings to justify establishing several separate or "isolated" plants.

A single station for all the generators and the steam power being decided upon, its location is determined by the following considerations: It should be easy of access from the river and from the railroad, in order to facilitate the delivery of machinery, coal, and other materials and supplies, and it should also be placed where there is a supply of water, where ashes may be readily disposed of, and where the unavoidable dirt, smoke, and noise of the machinery will not be objectionable. A central location with respect to the buildings to be lighted is of course desirable.

An examination shows that there is no existing building on the reservation fulfilling these conditions which is also of sufficient size and adapted to the other requirements of a central station, and it is therefore proposed to erect a new building on a site west of the railroad track and near the northern end of the tunnel. It is believed that this location offers a better combination of favorable conditions and fewer unfavorable ones than any other site available.

With the central station at this point, the cadet barracks and Academy proper will be at a distance of about half a mile. The hotel and the "center of distribution" for the officers' quarters north of cadet barracks will be about a quarter of a mile distant. The center of distribution for the officers' quarters south of cadet barracks will be at a distance of about three-quarters of a mile, while that for the soldiers' barracks and quarters, the soldiers' hospital, etc., will be only an eighth of a mile from the station.

The most distant lamps will be those at the south guard-house and in the officers' quarters near by, which are about 1 mile from the site proposed for the central station.

For a large incandescent plant, where the lamps are so widely scattered and where conductors of such varying lengths are required, the "direct" or continuous current

system is not well adapted, since for the long circuits very heavy conductors would be necessary in order to insure uniformity in the brightness of the lamps and economical working, a number of generators would have to be employed, each adapted to a group of lamps requiring about the same length of circuit. It has therefore been decided to adopt the "secondary" or alternating current system throughout, in which the above objections are mainly obviated. The secondary system will afford sufficient flexibility to meet the requirements of the service, while for long circuits it is more economical in first cost of line construction and in expense of operation.

The estimate of the total number of lamps required is based upon the number of gas-burners now in use, which is 2,745. Besides the gas-burners there are also employed in the soldiers' barracks and other buildings a considerable number of oil lamps, which it is proposed to replace by electric lamps, and in the cadet barracks it is proposed to put two lamps in each room where only one gas-burner has been furnished heretofore. The new academy and gymnasium buildings will also require additional lights, and a number of the existing gas-lamps, particularly those used for lighting the grounds, will be replaced by electric lamps of greater power than the standard 16 candles. It is also probable that in establishing the new system more efficient lighting will be called for in other localities where gas or oil is now used, requiring more burners than are now employed, so that the estimate is made for a total of 3,500 16-candle lamps, of which it is calculated that the greatest number that will be in operation at any one time will not exceed 2,000.

The central station building is to be a plain brick structure with brick chimney and metal or slate roof, and while not intended to be fire-proof it will not be easily combustible. It is to have a room for the engines and electric apparatus, a separate boiler-room, rooms for oils, stores, etc., and a coal-shed. Owing to the great irregularity of the service required, both the steam-power and the electric generators will have to be designed for unusual "flexibility." During the summer encampment the lamps in cadet barracks and in many other of the academy buildings, as well as a large portion of those in the officers' quarters, will not be used, while the demand for lights at the hotel and in the cadet camp will of course be greater than at other times of the year. In the winter season, when the total number of lamps in use will be greatest, the number in operation at different times of the night will be exceedingly variable.

The maximum "load" will begin soon after the return of the cadets from supper and will continue till "taps," when a large number of lamps are extinguished and the load will be greatly diminished. A considerable number will be required in officers' quarters, etc., until midnight, but comparatively few, including those used for lighting the grounds and in certain hallways in hospitals, etc., will be operated all night. For a service of such a variable nature a number of generators with engines and boilers to correspond are evidently preferable to one or two generators of large capacity with large power units, and for this reason the high-speed, noncondensing type of engine with direct belting to the dynamos is recommended; though, for a plant of this size where the service is more regular, compound condensing engines or engines of the Corliss type would be the more economical, as the greater first cost would be overbalanced by the saving in cost of fuel and other operating expenses.

For cadet barracks the importance of an uninterrupted service is such that this circuit should have its special generating apparatus, which should be in duplicate, but it will not be necessary to provide special duplicate engines, since there will always be a reserve of power and interruptions due to accidents to the steam apparatus are not so liable to occur. Three boilers are provided for, one of which is ordinarily to be held in reserve. Should it be necessary other less important circuits could be shut [illegible] in order to keep the lamps at cadet barracks in operation.

[illegible] the generators to operate the other circuits, duplicate armatures only are con[illegible]ated.

[illegible]de circuits in general overhead wires supported on poles will be used, [illegible]believed that the requirements are such as to justify the increased

expense of underground conduits, except perhaps in a few special localities. Conductors are to be covered throughout with best gum insulation, and poles, cross-beams, brackets, etc., are to be smoothly finished and painted. The very best methods and machinery known for overhead-line construction will be required in order to insure *safety* and reliability in the circuits.

All interior wiring is to be "concealed work" wherever practicable, and, where not, molding strips are to be used to cover the wires. No "cleat work" or exposed wires is to be permitted, except in basements and other special localities where the conditions may render this method of wiring preferable. For each cadet room it is proposed to supply two portable adjustable table lamps with flexible conducting cords and shades. This will give each cadet a light for his individual use and under his individual control, and in case one lamp becomes extinguished no great inconvenience will result.

In other cases where practicable the lamps are to be placed on existing gas-fixtures without interfering with the use of the gas. In the new buildings to be erected and in certain other cases, new fixtures adapted to the electric lamps alone will be required.

A small arc-light plant for lighting the riding hall and for other uses where arc lamps may be required is included and a number of motors are provided for.

A complete outfit of measuring and test instruments will also be furnished with the apparatus.

Assuming that the work is to be done by contract, it is recommended that separate advertisements be issued for the station building, for the steam-power apparatus, and for the electric plant complete, respectively. The specifications conform to this recommendation, and they prescribe the methods of inspection and test of all material and apparatus during construction, and the final test of the completed plant in operation before acceptance.

The estimates of cost are based upon the best information obtainable, from the experience of this office in similar work, and from consultation with reliable companies engaged in the business. These estimates are necessarily somewhat general in their nature, but they are believed to be at least approximately correct, and it is probable that the actual cost will fall within the amounts given if competition is secured by the usual advertisements inviting proposals.

I desire to acknowledge the many courtesies extended to me by Capt. C. W. Williams, quartermaster of the Academy, who has supplied complete information concerning the present gas plant, and in many other ways facilitated the preparation of this report.

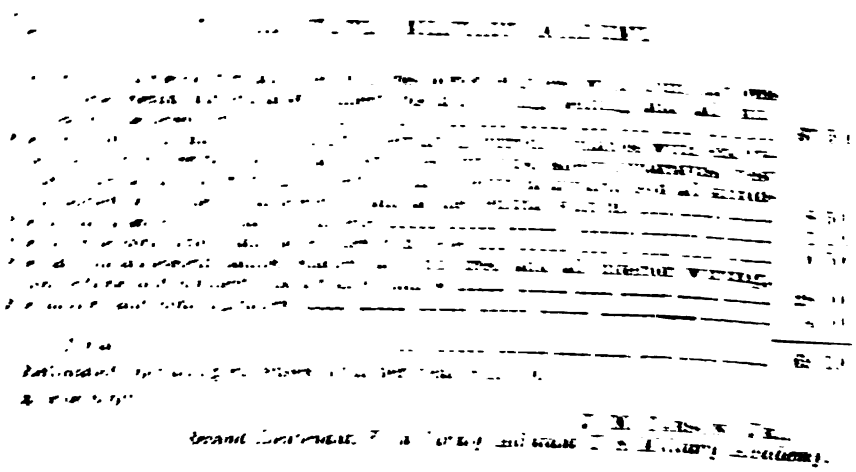
Very respectfully, your obedient servant,

JOHN MILLIS,
First Lieutenant of Engineers, U. S. Army.

Col. JOHN M. WILSON,
Corps of Engineers, U. S. Army,
Superintendent U. S. Military Academy, West Point, N. Y.

Estimate for electric-light plant for the U. S. Military Academy, West Point, N. Y.

Total number of lamps of 16 candle-power to be established	3,500
Total number of arc lamps of 2,000 candle-power to be established	10
Greatest number of incandescent lamps to be operated at any one time	2,000
For brick central station building complete, to contain engine-room, boiler-room, coal shed, storerooms, etc., to have brick chimney and noncombustible roof covering, and including grading and filling, construction of necessary road, piping for water supply, etc	$7,500
For three 100 horse-power boilers and setting, with pump, heaters, chimney connections, piping, and all fixtures complete	6,000



THE WEST POINT HOTEL.

The West Point Hotel has been for many years an object for the [illegible] of the Academic authorities, and [illegible] a public evil that is to be abated. The cause of the [illegible] the occasion only when a new departure is made in the [illegible] of the hotel. The present lessee pays an annual rental of $[illegible] and by the terms of his lease is required to expend for repairs $[illegible] each year, thus making the actual rental $[illegible]. The building was constructed more than 60 years ago from funds received from the sale of timber cut on the reservation. Some additions have been made to the original building, but none have been made within late years. It contains about 60 rooms, the greater number of which are small, in almost every respect undesirable, and in many respects uncomfortable. There is but one bathroom in the house, and during the last days of the annual examinations this solitary bathroom has not infrequently been assigned to a guest for a sleeping apartment. The desirable rooms are so few as to be insufficient for the accommodation of the Board of Visitors, which consists of twelve members, most of whom are always accompanied by ladies of their families.

During the month of June the hotel is always crowded to its utmost capacity, the people being compelled to submit to discomfort for the reason that they can not be accommodated elsewhere on the post, the nearest hotel being about 2 miles from the academic buildings. In addition to this reason for submission to physical torture, the majority of the visitors go to West Point to see their sons and brothers, who are in the corps of cadets, and these relatives naturally desire to be where every opportunity can be improved to enjoy the society of their relatives. Those who are familiar with the rigid regulations of the Academy, and know how little time the cadet is allowed for visiting, will appreciate the value placed by parents and relatives on the privilege of being lo-
[illegible] at the West Point Hotel, particularly when it is known that [illegible] are not permitted to leave the reservation, that even the West

Point Hotel, which is located on the edge of the cavalry plain, is "off limits" for cadets, and can be visited by them only with special permission, and even then only at certain hours.

The hotel was originally intended for a boarding house, to accommodate those who are required to officially visit the Academy, the parents and relatives of cadets, and officers of the Army. Like many other antiquated things at West Point, the Military Academy has grown very far beyond the hotel. Having to pay a rental of $4,000 per annum, the lessee is obliged to fix his prices at figures which will insure at least an income to that amount, and these prices are very generally regarded as in excess of the value of the accommodations provided. It should be stated in this connection that the lessee has not more than four months of the year upon which to rely to secure from the public the money necessary to pay the United States for the privilege of managing this ancient hostelery. During the winter months very few guests are entertained, and for days in succession the house is without guests. The lessee, however, is obliged to keep the hotel open and be prepared for the stranger at all times. So long as the Government continues to exact an exorbitant rental for this hotel the public will be compelled to suffer the inconvenience and submit to the high prices described. The landlord must take from the people in order to pay over to the Government annually the sum of $4,000, which amount is credited to the post fund and expended for public purposes. We submit that it is unworthy this great Government to be thus engaged in a copartnership with hotel men, livery-stable men, and others to make profits by imposing a tax upon the people who are attracted to West Point, and we trust that this discreditable practice will be discontinued. The Government is abundantly able to maintain the Military Academy without descending through its military officers to the petty business of assessing visitors to make up a portion of the outlay necessary to maintain this national institution.

What is needed in this direction for the public accommodation is the removal of the present hotel and the erection on its site of a hotel capable of accommodating 400 or 500 persons, and so constructed that a section could be kept open in the winter season without entailing unnecessary expense upon the proprietor. It is not probable that Congress can be induced to make an appropriation for this purpose, and the Board does not believe that it would be advisable to do so. But we do believe that Congress should pass an act by which the people may visit West Point and find comfortable accommodations at fair and reasonable prices. This may be accomplished if, instead of putting up to the highest bidder the privilege of leasing the hotel, authority be given the Secretary of War to make a lease for a long period of time with a responsible and experienced hotel keeper, conditioned that the lessee shall expend a certain sum in the erection of a hotel on the site of the present building, and that he shall maintain and conduct the hotel under regulations to be approved by the Secretary of War.

In the interest of the young men there should be in connection with the Military Academy at West Point a modern hotel and well-equipped hotel, at which parents of cadets and other visitors to the Academy would be entertained at such prices as would bring it within the reach of persons of moderate means. As at present conducted persons of moderate means can not stand the hotel charges and those persons who can feel that they are the victims of a system which, whatever the necessity for its establishment, is maintained without reason or justification and apparently for the sole purpose of filching from the public, through the agency of the lessee of the hotel, the sum of $1,000 per year to assist the Government of the United States in maintaining the Military Academy. The money already received by the United States from the rent of this hotel aggregates a sum largely in excess of the cost of its erection and all improvements made thereon.

The present lease on the hotel will expire in August, 1892, and we earnestly recommend that it be not renewed. If authority can not be obtained to arrange for the erection of a new building without expense to the United States we recommend that the old hotel, with all its inconveniences, discomforts, and harassments, be leased to the present lessee, or some other responsible and experienced man, at a nominal sum, say $1,000 per annum, all of which should be used in the making of such repairs as may be required on the hotel property.

THE KINSLEY PURCHASE.

In this connection attention is directed to the Kinsley property, which was recently acquired by the Government and added to the West Point reservation. There is on the Kinsley purchase an old and somewhat dilapidated frame dwelling house, upon which the Government last year expended in repairs $1,500. This was an expenditure of doubtful propriety. The building has passed the period when repairs can be made with profit. It is proposed by the Superintendent to lease this Kinsley "mansion" and convert it into a boarding house, the lease to include a number of acres surrounding the house. With a boarding house established on the Kinsley purchase the West Point Hotel would be relieved during the summer months of the overcrowding that is usual, additional accommodations would be provided for visitors, and those who are unable to withstand the exactions at the hotel, made necessary by the demands of the Government to participate in the profits, would be able to find a place to lodge. We recommend that

dwelling and a certain number of acres surrounding it be

responsible party for conversion into a boarding house. If

we we trust the Secretary of War will exercise his

it an extension to the Kinsley purchase of the sys-

the Government a direct beneficiary of the profits

resulting from conducting the West Point Hotel. Grant for a term of years a lease of the Kinsley house and surrounding acres to any reputable and responsible parties for a merely nominal sum, conditioned that the house shall be made comfortable for the accommodation of guests and that it will be conducted in accordance with regulations to be approved by the Secretary of War, but keep the Government out of the partnership.

What is here said in deprecation of the lease of the hotel applies to the leasing of the privilege of maintaining horses and vehicles on the post, a privilege which should go with the lease of the hotel.

THE ENGINEER BARRACKS.

The condition of the barracks occupied by the engineer company is discreditable and should be given immediate attention. Considerable repairs are needed to make the barracks comfortable. Several large stoves are used on each of the floors for heating purposes. These should be removed and a plant substituted for steam-heating. Due regard for the lives of the men and safety of the public property demand that steam should be substituted for the stoves in use, leaving out of consideration the saving in money that would be effected in the consumption of coal.

A new range is also urgently needed for the kitchen. The sinks, which are in close proximity to the barracks, are in a dilapidated and leaky condition. The bowls in use were condemned and removed from dwellings on the post, and were unserviceable when utilized for the closets of the engineer barracks. If these sinks were within the corporate limits of any town those responsible for the nuisance created would be liable to prosecution. The men of the engineer company are mostly young Americans of fine appearance and martial spirit, who have joined this corps for the educational advantages presented, and should be given proper consideration by the military authorities as to the ordinary comforts usual in garrisons in the East. At least $1,000 should be specifically appropriated for the repair and renovation of the engineer barracks and the immediate surroundings.

REPORT OF THE COMMITTEE.

Following is the report of the committee on Buildings and Grounds:

ROOMS OF THE BOARD OF VISITORS,
West Point, N. Y., June 8, 1891.

To the Board of Visitors:

Your committee on Buildings and Grounds have the honor to report as follows:

Immediately after appointment the committee waited upon the Superintendent for such information as was necessary to the conduct of their inquiries, and were furnished with memoranda hereto attached directing their attention to certain immediate requirements of the Academy and post.

These matters were thoroughly examined and inquiries extended in other directions as far as deemed advisable.

The committee desire to express their unqualified admiration of the attention given by the superintendent and his subordinates to the preservation and care of the buildings and grounds.

The liberal appropriations recently made by Congress cover with few exceptions all the important new constructions required. There are, however, some additional buildings needed for the comfort and convenience of the officers, cadets, and members of the garrison.

These, in connection with repairs and improvements as outlined by the superintendent, and which will be recommended in his report to the Secretary of War, are in the main earnestly approved by the committee, many of them being sanitary requirements.

The old wooden buildings at the north side of the post are unfit for occupation and should be removed as rapidly as possible.

The noxious gases arising from the drain under cadet barracks, which is connected with the bath rooms and urinals, indicate the necessity for their removal to a separate building.

The improvement of the sewers and plumbing of officers' quarters and administrative buildings is proceeding under an old appropriation, which is not sufficient to carry the work to completion.

The attention of the committee was especially called to the fact that the space in the library is entirely inadequate to accommodate the books. There are now 34,000 volumes on hand and the number is rapidly increasing. Books are now piled about in every nook and corner.

It is proposed by the superintendent to make the necessary enlargement by throwing open those portions of the building at present occupied by the department of philosophy, which will be vacated upon the completion of the new academic building, and also the rooms formerly occupied by the administrative officers and now vacant. This change will afford about double the present space.

To effect this change and to construct the ceiling in keeping with the building the assistance of an architect is required. An appropriation of $2,500 is recommended for the employment of a skilled architect for this purpose.

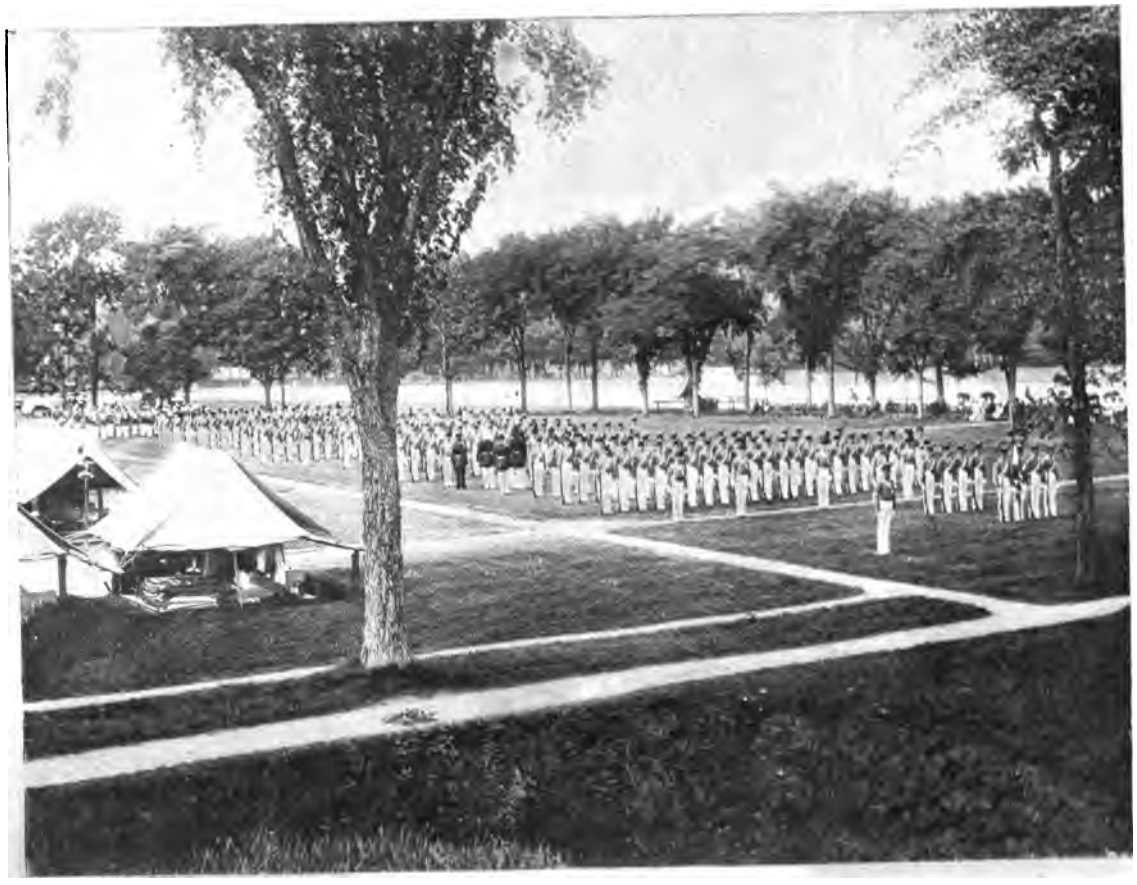
The committee can not close without remark upon the inadequacy of the hotel to accommodate the visitors at this season of the year. The fittings are antiquated and uncomfortable and not in keeping with the times. It should be renovated throughout. We are informed that the present leaseholder pays a rental of $3,500 per annum and that his lease expires in 1892. The patronage is such as should enable the proprietor to afford his guests comfortable accommodations. When a new lease is made the buildings should be newly furnished throughout by the lessee.

In this connection the committee would call attention to the suggestion of the superintendent that he be empowered to lease the Kensley Mansion and 10 acres of ground surrounding it for a term of years and upon such terms as the Secretary of War may deem most desirable for hotel purposes. This would relieve the present establishment, take care of the overflow during the summer months, and by competent management afford comfortable accommodations to the parents and friends of cadets.

Aside from the points mentioned we find nothing coming within the scope of our inquiries to criticise.

Respectfully submitted.

D. W. PAYNE.
S. W. T. LANHAM.
ROBERT Q. FULLER.



INFANTRY BATTALION, PREPARED FOR INSPECTION.

SUPPLIES AND EXPENDITURES FOR CADETS.

Committee on Supplies and Expenditures for Cadets.—Messrs. JULIUS C. BURROWS, SAMUEL W. T. LANHAM, and JOHN M. CARSON.

The Department of Cadet Supplies is in charge of Capt. W. F. Spurgin, Twenty-first Infantry, whose remarkable ability in this particular line of duty has been so conspicuous as to induce the authorities to retain him beyond the usual period set apart for a term of service at the Academy. The Board made a thorough inspection of this department, and, although its administration embraces several distinct lines of duty and a variety of detail, it was found in perfect order, with machinery working harmoniously, every division of labor and responsibility being under the constant supervision of one head and the results being satisfactory to the cadets, for whose benefit this organization was created.

Captain Spurgin sustains a variety of relations to the cadets. First, he is treasurer, and as such receives all moneys allowed for pay and disburses it; second, he is quartermaster for the Cadet Corps, purchasing all supplies in the form of clothing and having all articles of uniform, including shoes, made up, each cadet being measured for his clothing; third, he is commissary for the Corps of Cadets, purchasing all subsistence supplies needed and having these prepared, cooked, and served. In short Captain Spurgin has charge of everything connected with the feeding, clothing, washing, mending, and furnishing of bed rooms for the cadets. To discharge these multifarious duties with a degree of efficiency to give satisfaction requires, in the first place, taste, aptitude and industry and, in the second, careful training and extended experience. These are combined in Captain Spurgin.

We concur in the recommendations made by previous Boards of Visitors that Captain Spurgin should be permanently attached to the Academy and continued in the discharge of his present duties. We believe the interests of the Academy and the military service would be promoted by appointing this officer to the pay corps of the Army, to the end that, in addition to his present duties, he could perform the duty now performed by a regular paymaster in paying the officers of the Military Academy and the troops constituting the post of West Point.

This department is closely related to the well-being of the individual cadet and the discipline of the corps. If the food furnished be not sufficient in quantity, wholesome in quality, well-cooked, and properly served there will be discontent, resulting in demoralization and the un-

dermining of discipline. The testimony of the cadets to the character of administration of Captain Spurgin is supplemented by the universal commendation of the officers at the Academy, and both these are given emphasis by the splendid discipline of the Corps of Cadets.

The Board visited the several divisions of this department in a body and found each in the highest state of efficiency. The laundry is well supplied with all necessary machinery and appliances for the performance of the best class of work, and is managed with skill and economy; the quartermaster's division is well supplied with everything needed for the comfort and convenience of the cadets, and when the building to be used as a storehouse is constructed, which was authorized by the last Congress, the capacity of the tailor and shoe shops will be materially extended; the kitchen and pantries of the cadet mess are in good order and well supplied with all necessary machinery and utensils.

Members of the Board visited the kitchen at different times during the preparation for meals, and upon one occasion, without previous notice to Captain Spurgin or any of his assistants, we proceeded in a body to the dining hall after the corps was seated for dinner, and each member selecting a table, so that we were scattered over the hall, had the pleasure of dining with the cadets, and in this way were enabled to test the quality of the food served. From this experience, as well as from close scrutiny into all the methods employed in preparing, cooking, and serving the food, we have no hesitation in saying that the meals furnished the cadets are as good as can be supplied with the means at hand, and that, as regards quantity, variety, preparation, wholesomeness, and service, they are all that can be desired. The cost for board to each cadet is between $16 and $17 per month.

The character and variety of the duties performed by Captain Spurgin and the method of disbursing the pay of cadets is best explained in the words of that officer:

I perform the duties of treasurer of the Military Academy, and have the management of all affairs appertaining to the cadet quartermaster's department, cadet subsistence department, and cadet laundry. The treasurer handles all moneys appertaining exclusively to cadets personally and to the above-named departments. The receipt and disbursement of such moneys requires twenty-eight separate and distinct accounts.

The cadet quartermaster's department supplies everything required by a cadet for his personal service (excepting his subsistence), and which is paid for out of his pay.

The cadet subsistence department supplies the cadet his food, which is well cooked, wholesome, and in variety according to season.

All supplies are purchased in open market, wherever the best article at least cost may be obtained.

The pay of each cadet is $45 per month, or a total of $540 a year. In addition he receives medical attendance and medicines, quarters, fuel for heating same, and coal for gas, free; he also derives benefit from all general appropriations for the Academy.

The income of a cadet is expended for his subsistence, clothing, text-books, for services of all persons connected with the domestic branch of the Academy, such as the barber, shoeblacks, those engaged in policing the barracks, for laundrying and in defraying all of his necessary expenses at the Academy.

Four dollars of his monthly pay is set aside each settlement, and constitutes what is known as his equipment fund, amounting during the four years to $192; which *sum he* receives on graduation, or in case his connection with the Academy is severed prior to graduation, the accrued amount, whatever it may be.

Cadets found deficient receive whatever may be due to date of discharge, and in addition a sum equivalent to one day's pay as a cadet for every 20 miles of the distance from West Point to their homes, as determined by the official table of distances published by the Paymaster-General U. S. Army; he also receives through the disbursing officer of the Academy, from Congressional appropriation, the actual cost of his traveling expenses, including sleeping-berth, to his home.

I consider the income of a cadet, taken in connection with the sum which he deposits on entering the Academy—viz, $100, and which defrays the cost of his first outfit—sufficient, but no more than sufficient, for all of his actual necessities under economical management.

STATEMENT OF CAPT. W. F. SPURGIN.

HEADQUARTERS U. S. MILITARY ACADEMY,
OFFICE TREASURER, QUARTERMASTER, AND COMMISSARY OF CADETS,
West Point, N. Y., October 6, 1891.

SIR: Referring to exhibits F-A and F-B, pages 100 to 104 inclusive, Report of the Board of Visitors to the U. S. Military Academy for 1887, I have the honor to transmit herewith the following:

Abstract of cost of provisions, property, etc., used, issued, and consumed at the cadet mess U. S. Military Academy, West Point, N. Y., from May 1, 1889, to May 30, 1891, four years, which taken in connection with exhibit F-A above referred to, completes the table for seventeen years previous to date last above given.

The notes relative to the cadet mess following exhibit F-A, Report of 1887, are respectfully referred to, exhibiting correctly the workings of the mess to-day.

Statement exhibiting the work performed at the cadet laundry, West Point, N. Y., during the year ending April 30, 1891, with schedule of prices changed for laundry work.

The extension of the laundry asked for in 1887 was granted and now the cadet laundry is well equipped with necessary machinery and is of sufficient capacity.

Memorandum of clothing manufactured and repaired in the tailor shops, cadet quartermaster's department, for the year ending April 30, 1991.

Many members of the graduating class took advantage of their privilege to obtain their uniform dress coats, trousers, blouses, and capes at the Cadet Quartermaster's Department, and the articles of officers' uniform mentioned above were principally for members of the graduating class.

The addition to the cadet quartermaster's storehouse, authorized by Congress, is approaching completion and will when finished supply the necessary room for storage of supplies, workshops, etc.

Respectfully submitted.

W. F. SPURGIN,
Captain of Twenty-first Infantry,
Treasurer U. S. Military Academy, Quartermaster and Commissary of Cadets.

Maj. JOHN M. CARSON,
Secretary Board of Visitors
U. S. Military Academy, Washington City, D. C.
(Through the adjutant's office, U. S. Military Academy.)

Abstract of cost of provisions, property, etc., used, issued, and consumed at the cadets' mess, U. S. Military Academy, West Point, N. Y., from May 1, 1887, to April 30, 1891.

From—	To—	Provisions.	Contingent property.	Furniture.	Incidentals.	Total.	Average number of cadets.	Cost of board.	Assessed for board.
May 1, 1887	Apr 30, 1888	$41,997.93	$1,303.95	$683.51	$6,549.12	$50,514.51	263	$192.97	$192.00
May 1, 1888	Apr. 30, 1889	41,083.63	1,513.21	865.00	5,803.05	49,264.89	256	193.43	194.00
May 1, 1889	Apr. 30, 1890	40,616.56	1,435.38	623.63	7,035.47	49,710.04	260	191.87	192.06
May 1, 1890	Apr. 30, 1891	38,867.57	829.15	1,160.61	6,891.95	47,749.28	259	184.88	183.40

Tabulated statement of number of articles laundried from July 1, 1890, to June 30, 1891.

Month.	Clothes-bags.	Shoes.	Pillowcases.	White shirts.	Nightshirts.	Under shirts.	Drawers.	White trousers.	White jackets.	Towels.	Socks, pairs.	Gloves, pairs.	Handkerchiefs.
1890.													
July	871	724	580	1,555	366	2,720	2,598	8,610	380	3,862	3,201½	3,752½	4,844
August	403	782	553	1,377	323	2,520	2,587	8,559	67	3,683	2,885	4,017½	4,097
September	.....	1,879	1,229	1,97	954	3,170	2,944	6,353	328	5,081	3,56	4,888	6,077
October	.....	1,650	982	1,583	794	3,321	2,247	45	6	4,024	2,660	2,508½	4,316
November	.....	1,406	96	1,385	795	3,358	2,268	16	.....	3,946	2,63	2,352½	4,754
December	526	2,106	1,250	1,862	951	3,068	2,860	.....	.....	5,029	3,312½	2,531	6,066
1891.													
January	.....	1,793	957	1,340	763	2,242	2,082	1	....	3,854	2,484½	2,203½	4,807
February	.....	1,67	946	1,276	736	2,234	2,13	43	11	3,870	2,441	2,114½	4,393
March	305	2,08	1,125	1,605	932	2,794	2,72	6	3	4,912	3,009	2,667	5,563
April	.....	1,691	955	1,394	778	2,82	2,155	6	.....	3,997	2,534½	2,344½	4,706
May	.....	1,69	953	1,469	73	2,85	2,17	3,285	386	4,689	2,797	2,790½	4,629
June	.....	1,226	717	1,509	679	2,64	2,127	6,441	364	4,065	2,840	3,151	4,496
	1,805	19,028	11,209	18,688	8,862	30,872	28,909	33,367	2,115	50,712	34,369	35,321	58,748

Month.	Cuffs, pairs.	Collars.	Shoulder belts.	Waist belts.	Sword belts.	Gray trousers.	Gray jackets.	Blankets, single.	Aprons.	Vests.	Dusters.	Bathing suits.	Total pieces.
1890.													
July	4,403	8,976	1,596	1,600	247	2	.....	2	1	.....	1	14	50,315½
August	3,54	8,36	1,824	1,82	28	2	2	4	.....	.....	.....	11	48,264
September	4,35	8,36	1,83	1,86	47	2	1	175	26	.....	2	14	55,82
October	1,744	4,21	780	79	19	4	4	6	5	.....	.....	1	32,387½
November	1,65	4,274	745	745	196	6	2	6	.....	.....	.....	1	31,852
December	3,250	5,361	624	676	28	1	5	7	1	.....	.....	.....	39,325½
1891.													
January	2,135	4,794	728	729	228	4	.....	2	1	.....	.....	3	30,128
February	1,92	4,17	71	71	17	.....	.....	.....	.....	.....	.....	1	30,089½
March	3,3	5,59	880	88	27	14	2	1	.....	.....	.....	.....	36,460
April	2,80	5,38	73	73	27	4	.....	2	.....	.....	.....	1	32,462½
May	3,2	5,58	94	94	27	24	28	2	1	1	1	.....	38,510½
June	3,45	6,88	1,6	1,64	17	4	29	2	2	5	3	3	44,345
	35,21	73,6	17,5	17,8	1,38	67	111	45	5	7	49	472,256½

Memorandum of clothing manufactured and repaired in the tailor shops, Cadet Quartermaster's Department, for the year ending April 30, 1891.

Articles.	Manufactured.	Repaired.
Blouses:		
Gray	362	640
Officers	60	.....
Coats:		
Dress	216	375
Over-	160	276
Jackets:		
Shell	59	.....
White	175	.....
Trousers:		
Gray	565	1,083
Riding	59	.....
Flannel	81	.....
White	644	1,666
Officers	106	.....
Dress coats, officers	17	.....
Officers' capes	16	.....
Total	2,520	4,039

Laundry price list.

	Cents.		Cents.
Clothesbags	2	Cuffs, pairs	2
Sheets	3	Collars	1
Pillowcases	2	Shoulder belts	1
White shirts	3	Waist belts	1
Nightshirts	3	Sword belts	1
Undershirts	2	Gray trousers	10
Drawers	2	Gray jackets	10
White trousers	4	Blankets, single	10
White jackets	4	Spreads	10
Towels	2	Vests	4
Socks, pairs	1	Dusters	3
Gloves, pairs	1	Bathing suits	2
Handkerchiefs	1		

REPORT OR THE COMMITTEE.

Following is the report of the committee on Supplies and Expenditures for Cadets:

WEST POINT, N. Y., *June* 9, 1891.

To the Board of Visitors:

The committee on Supplies and Expenditures for Cadets submits the following report:

Your committee made frequent and careful examination into the supply department, visiting the mess hall and kitchen at various hours and making an inspection of the food and clothing supplies. In every particular the high standard of excellence in the quality of materials and in their intelligent preparation for the consumption of cadets which has marked the administration of this department under the direction of Capt. W. F. Spurgin has been maintained.

The supplies purchased are of the very best quality and the prices paid are as low as similar supplies can be purchased in the wholesale markets. The system of accounts is perfect and are so kept that the entire history of every individual transaction may be exhibited at any time. Recent improvements and additions made to the culinary department seem to make further expenditure unnecessary at this time. The dining hall, however, should be supplied with a tile floor. The present wood floor is in fair condition, but will necessarily have to be replaced the coming year. The daily tramp of nearly 300 men three times each day is calculated to wear out a wood floor in a comparatively short time.

GRANT HALL CADET DINING ROOM.

FISCAL AFFAIRS OF THE ACADEMY.

Committee on Fiscal Affairs.—Messrs. JOSEPH A. SCRANTON, ROBERT O. FULLER, and DAVID W. PAYNE.

The fiscal affairs of the Academy and the methods of administration are set forth in the report of the committee in charge of this branch and the papers which accompany the report. The pay of a cadet is $45 per month. The corps is mustered for pay every two months, when muster rolls are made out by the tactical officers in charge of cadet companies. These rolls are transmitted by the commandant of cadets to the treasurer of the Academy, by whom they are in turn transmitted to the chief paymaster of the Department of the East at New York. An officer of the Pay Corps is then designated to pay the rolls, and this officer deposits the amount required to do this with the assistant treasurer of the United States at New York to the credit of the treasurer of the Military Academy, to be drawn upon by the latter in his official capacity as treasurer of the Corps of Cadets. When thus drawn the money is credited to the cadets individually, but the cadet is not permitted to handle any part of this money nor permitted to have in his possession money from any source whatever. When he goes on furlough at the end of two years from entrance or when he severs his connection with the Academy, he is given whatever money is due him, but under no other circumstances, and at no other times, is the cadet permitted to be possessed of money.

The account of each cadet is kept by the treasurer of the Academy, each individual being furnished with a pass book upon which all items of debit and credit are entered, so that the cadet can see at all times how his account stands. Out of the monthly pay of each cadet there is set aside the sum of $4, thus reducing his allowance for subsistence to $41 per month. The $4 held back is for the purpose of creating an equipment fund with which to purchase the necessary outfit upon graduation. This equipment fund amounts to $192 in four years. Out of the remaining $41 of his monthly pay the cadet must pay for subsistence, clothing, washing, text books, policing barracks, gas, barber, baths, shoeblack, etc. Subsistence costs about $16 per month. The cost of clothing depends upon the care exercised by the individual cadet. Washing is an expensive item in summer when white clothes are worn, but it is not so expensive as a [illegible] barracks a charge of 85 cents per month is mad[illegible]d the charge for

gas is 50 cents per month. The charge for baths, shoeblack, etc., vary from 60 to 80 cents per month. Notwithstanding these numerous charges the pay of the cadet is sufficient to maintain him at the Academy by the exercise of proper economy. In the enforced economy which he is obliged to constantly practice the cadet acquires habits of economy which usually adheres to him through life. At all events he is taught to practice economy in his personal expenditures while at the Academy and the lessons thus inculcated for a period of four years can not fail to be beneficial.

REPORT OF THE COMMITTEE.

Following is the report of the committee on Fiscal Affairs:

WEST POINT, N. Y., *June* 9, 1891.

To the Board of Visitors:

The committee on Fiscal Affairs respectfully present the following report:

We have carefully examined the methods of conducting the fiscal affairs of the Academy and find they are dual in character. First, that which relates to the pay, subsistence, and clothing of the Corps of Cadets, and second, that which relates to the building and grounds and the subsistence of the enlisted men of the garrison of West Point and of the animals used in the cavalry and artillery instruction of the cadets. The former is under charge of Capt. W. F. Spurgin, Twenty-first Infantry, and the latter under Capt. William H. Miller, of the Quartermaster's Department.

Your committee visited the office of Captain Spurgin, examined his records and books of account, and received from him a full verbal explanation of the way in which he conducts his exceedingly interesting and important department.

From the examination of the office made by your committee the following appears:

The pay of a cadet is $45 per month. Every 2 months a muster-roll of each company of cadets is made out and these rolls are forwarded by Captain Spurgin to the proper paymaster. They are then paid by placing to the credit of Captain Spurgin, as treasurer of the United States Military Academy, with the assistant treasurer of the United States at the city of New York, the entire sum of the rolls.

In Captain Spurgin's office twenty-eight separate accounts are kept. His office is the bank of the cadets. Their personal deposits consist of the sums deposited by them when they first report and their regular bimonthly pay.

The cadet never handles any part of his pay excepting when he goes on furlough or severs his connection with the Academy. Captain Spurgin keeps an account with each cadet. Each cadet has an account book and can see at any settlement just how his account stands and the items of debit and credit of which it is composed.

Out of the monthly pay ($45) of the cadet there is withheld the sum of $4 monthly. This is under no circumstances to be expended prior to his graduation. It makes what is termed the equipment fund, and in 4 years amounts to $192. It is expended by the cadet upon his graduation in buying his equipment as an officer.

Out of the $41 thus remaining as the available monthly pay of the cadet all of his expenses are paid through Captain Spurgin. The cadet thus pays for his subsistence, clothing, text-books, washing, policing barracks, gas, barber, shoe-black, baths, etc. His subsistence costs him upon an average about $16 per month. It is a close matter to live upon $41 per month, but it is done under this system and the cadet is taught that invaluable lesson, to live within his means.

Captain Spurgin's system of purveying and his management of the cadet mess are admirable in every way. The young men are well fed. This is the result of careful system and close personal attention to details by Captain Spurgin. He possesses great natural aptitude for his present position and it is the opinion of your committee that he should be retained in it.

Your committee also examined the books and papers of Captain Miller, and received from him full and satisfactory explanations of the methods of conducting business. Attached to this report is a statement from Captain Miller showing the amounts appropriated, disbursed, and remaining unexpended under the several heads of appropriations for the support of the Academy for the current fiscal year. There is also appended a statement from Captain Spurgin exhibiting condition of funds in his charge.

Attention is directed to the fact that the cadets were required to pay $1,017 for gas during the year. Your committee believe that Congress should make an appropriation for the manufacture of gas to avoid this charge against the cadets.

Your committee have no criticism to make upon the conduct of the fiscal affairs of the Academy so far as they are administered by Captains Spurgin and Miller. Both these officers conduct their business under systems made perfect by years of usage, and we found each of them efficient and industrious officers and attentive and courteous gentlemen.

Respectfully submitted.

JOSEPH A. SCRANTON,
ROBERT O. FULLER,
DAVID W. PAYNE,
Committee.

STATEMENT OF CAPTAIN MILLER.

HEADQUARTERS UNITED STATES MILITARY ACADEMY,
QUARTERMASTER'S OFFICE,
West Point, N. Y., June 9, 1891.

SIR: In accordance with your request, I have the honor to inclose herewith for the information of the Board of Visitors an abstract showing the amounts appropriated, disbursed, and remaining unexpended under the several heads of appropriations for the support of the Military Academy during the fiscal year 1890–'91.

The funds shown on the abstract as received have been supplied by request of the honorable Secretary of War upon requisition of the Superintendent of the Military Academy forwarded at such times as the necessities of the service demanded.

The amount reported as disbursed is supported by vouchers which are forwarded monthly to the War Department for the approval of the Secretary of War and then transmitted to the Treasury Department for audit.

The amount reported as unexpended is deposited to my official credit, as disbursing officer, in the subtreasury of the United States in New York City. At the end of the fiscal year such funds as are not needed to cancel outstanding indebtedness will be transferred to the Treasurer of the United States.

In addition to the funds referred to in Abstract A, herewith, I inclose an abstract of the fund known as the "gas fund."

Congress annually appropriates $3,500 for gas, coal, oil, candles, lanterns, matches, chimneys, and wicking for lighting the academy, chapel, library, cadet barracks, mess hall, shops, hospital, offices, stables and riding hall, sidewalks, camp, and wharves.

The gas consumed in these places cost more than the amount appropriated. A tax therefore becomes necessary. Gas consumed at all places not enumerated in the act is sold at actual cost of manufacture with a small increase for contingencies, which includes a portion of the deficiency above named and also provides for contingent repairs which experience has shown to be necessary from time to time. The remainder of the deficiency is charged to cadets. They pay for gas at the rate of 30 cents per month for the time they are actually present.

Attention is invited to the amounts paid by the several classes of persons consuming gas.

I also inclose an abstract of the fund known as the "Special contingent fund, U. S. M. A.," which is derived from the rent of certain public structures at this post. Congress authorizes its expenditure under the supervision of the Superintendent of the Academy, the same to be accounted for annually, accompanied by proper vouchers, to the Secretary of War.

Very respectfully, your obedient servant,

W. H. MILLER,
Captain and Assistant Quartermaster,
U. S. A., Disbursing Officer, U. S. M. A.

Hon. JOSEPH A. SCRANTON,
Chairman Committee on Fiscal Affairs.

Abstract of appropriations made for the support of the Military Academy for the fiscal year ending June 30, 1891, disbursed by Capt. W. H. Miller, assistant quartermaster, U. S. Army, disbursing officer U. S. Military Academy.

	Amount received.	Expended to include June 9, 1891.	Unexpended balance on hand.
Current and ordinary expenses	$61,431.15	$49,716.14	$11,715.01
Miscellaneous items and incidental expenses	21,020.00	16,123.33	4,896.67
Buildings and grounds	60,000.00	48,869.75	11,130.25
New Academy building	16,000.00	11,873.09	4,126.91
New gymnasium building	53,500.00	21,678.69	31,821.31
Total	211,951.15	148,261.00	63,690.15

I certify that the above abstract is correct, and that the expenditures reported have all been made by the undersigned on vouchers approved by the Superintendent of the Military Academy.

W. H. MILLER,
Captain and Asst. Q. M., U. S. Army, Disbursing Officer, U. S. M. A.
WEST POINT, N. Y., *June* 9, 1891.

Abstract of receipts and expenditures pertaining to the U. S. Military Academy gas fund, between July 1, 1890, *and June* 9, 1891.

Receipts:	
Sales of coke	$596.50
Sales of tar	514.46
Sales of gas to officers	1,533.53
Sales of gas to civilians	685.12
Sales of gas to buildings	473.58
Sales of gas to cadets	1,015.70
Sales of gas fixtures	37.33
	4,856.22
On hand July 1, 1890	655.16
Total	5,511.38
nded to include June 9, 1891	5,171.81
nded balance on hand June 9, 1891	339.57

I certify that the above abstract is correct, and that the expenditures reported have all been made by the undersigned on vouchers approved by the Superintendent of the U. S. Military Academy.

W. H. MILLER,
Captain and Assistant Quartermaster, U. S. A., Director of Gas Works.
WEST POINT, N. Y., *June* 9, 1891.

Abstract of receipts and expenditures pertaining to the special contingent fund, U. S. Military Academy, between July 1, 1890, *and June* 9, 1891.

On hand July 1, 1890		$645.54
Receipts:		
By rent of West Point Hotel	$3,500.00	
By rent of post-office cottage	112.50	
By rent of public stables	100.00	
By rent of confectionery store	787.50	
		4,500.00
Total		5,145.54
Expended to include June 9, 1891		2,473.14
Unexpended balance on hand June 9, 1891		2,672.40

I certify that the above abstract is correct, and that the expenditures reported have all been made by the undersigned on vouchers approved by the Superintendent of the U. S. Military Academy.

W. H. MILLER,
Captain and Asst. Quartermaster, U. S. A., Treasurer Special Contingent Fund.
WEST POINT, N. Y., *June* 9, 1891.

STATEMENT OF CAPTAIN SPURGIN.

HEADQUARTERS U. S. MILITARY ACADEMY,
OFFICE TREASURER, QUARTERMASTER, AND COMMISSARY OF CADETS,
West Point, N. Y., June 9, 1891.

SIR: In compliance with your verbal request, I have the honor to submit the following, viz:

(1) *Statement of the treasurer U. S. Military Academy, May* 19, 1890.

DR.	Amount.		Amount.	CR.
Assistant treasurer	$29,589.12	Cadet laundry	$4,724.52	
Cadet cash	70.00	Cadet quartermaster	7,731.98	
Trust funds	20,000.00	Cadet subsistence department	531.49	
Cash on hand	231.26	Corps of Cadets	7,211.21	
		Dialectic Society	25.48	
		Equipment fund	29,606.00	
		Miscellaneous fund	9.70	
Total	49,840.38	Total	49,840.38	

(2) *Statement of receipts and disbursements made by the treasurer U. S. Military Academy from May 19, 1890, to May 19, 1891.*

DISBURSEMENTS.	Amount.	RECEIPTS.	Amount.
Assistant treasurer (deposited)	$151,266.06	Assistant treasurer (amount of checks drawn)	$151 [illegible]
Balances paid	13,302 [illegible]	Balances paid	13,30[illegible]
Barber, etc	568.69	Barber, etc	568.69
Cadet cash	11,433.71	Cadet cash	11 [illegible]
Cadet hospital	2,615.81	Cadet hospital	[illegible]
Cadet laundry	8,643.28	Cadet laundry	9 [illegible]
Cadet quartermaster	72,222.57	Cadet quartermaster	66 [illegible]
Cadet subsistence department	55,501.72	Cadet subsistence department	55 [illegible]
Confectioner	148.00	Confectioner	148 [illegible]
Corps of Cadets	169,377.86	Corps of Cadets	175,73[illegible]
Damages, ordnance	24.24	Damages, ordnance	24 [illegible]
Dancing	615.00	Dancing	615.00
Dentist	719.00	Dentist	719.00
Deposits	16,642.53	Deposits	16,8[illegible]
Dialectic Society	317.13	Dialectic Society	510.40
Equipment fund	10,888.00	Equipment fund	12,926.00
Expressage	20.30	Expressage	20.30
Gas	1,070.60	Gas	1,07[illegible]
Hops and german	1,620.00	Hops and german	1,620.00
Miscellaneous fund	32.50	Miscellaneous fund	26.82
Miscellaneous items	545.64	Miscellaneous items	551.96
Oaths	20.50	Oaths	20.50
Paymaster	151,366.06	Paymaster	151,366.06
Periodicals	58.30	Periodicals	58.30
Photographs	70.50	Photographs	70.50
Policing barracks, etc	5,695.83	Policing barracks, etc	5,73[illegible]
Total	674,777.03	Total	676,345.00

(3) *Statement of the treasurer U. S. Military Academy, May 19, 1891.*

	Amount.		Amount.
Assistant treasurer	$29,715.84	Cadet hospital	$8.38
Paymaster	00.00	Cadet laundry	5,541.23
Trust funds	20,000.00	Cadet quartermaster	1,898.64
Cash on hand	1,709.23	Cadet subsistence department	667.82
		Corps of Cadets	11,571.51
		Deposits	190.00
		Dialectic Society	18.75
		Equipment fund	31,644.00
		Miscellaneous fund	4.02
		Miscellaneous items	6.32
		Policing barracks, etc	34.40
Total	51,005.07	Total	51,605.07

I have the honor to ask attention to the Report of the Board of Visitors for 1890, p. 19, where reference is made to previously published statements and communications from this office contained in the Reports of the Board of Visitors for 1887 and 1888, which give full information relative to the affairs of this office, and have the honor to be,

Very respectfully, your obedient servant,

WM. F. SPURGIN,
Captain Twenty-first Infantry, Treasurer U. S. Military Academy.

Hon. JOSEPH A. SCRANTON,
Chairman Committee on Fiscal Affairs.

HEADQUARTERS U. S. MILITARY ACADEMY,
West Point, N. Y., June 9, 1891.

[illegible] transmitted to Hon. J. A. Scranton, member Board of Visitors.
[illegible] of Colonel Wilson:

J. M. CARSON, Jr.,
Second Lieutenant Fifth Cavalry, Adjutant.

Copyright. Stoddard, Glens Falls, N. Y.

GUARD MOUNTING.

MISCELLANEOUS.

THE MILITARY ACADEMY BAND.

The condition of the Military Academy band was given careful consideration by the Board. The matter was discussed with Colonel Wilson and other officers of the Academy, and able arguments were made by Lieut. Edward E. Harden, of the Seventh Infantry, who has charge of the band, and by Bandmaster Clappé, in favor of a reorganization. These gentlemen presented facts and figures which impressed the Board with the belief that the band should be increased in numbers, and that it should be reorganized so that good musicians would be attracted to it. As at present constituted it is surprising that musicians of any merit can be induced to remain in the Academy band. Indeed, the greatest difficulty is experienced in securing musicians and in retaining them after they have been secured. The band is now limited to 24 pieces, and the men are graded into three classes, who are paid $17, $24, and $34 per month, respectively. It is notorious that the bands of the United States Army are poorly equipped, inadequately paid, and small in numerical strength. They are not to be compared with first-class civilian bands in our own country, nor with the regimental bands of any country which maintains a military establishment. While it is not within the province of this Board to offer suggestions and make recommendations so far as the bands of the Army are concerned, we do earnestly recommend legislation looking to the reorganization of the Military Academy band. Music has become an important factor in our national life, and viewed either in its educational tendencies or as a source of amusement for the people, should command the attention of the Government.

While private enterprise has furnished grand orchestras, splendid bands, and fine choral bodies, our Government has done absolutely nothing to keep pace with the growth and development of music, nor has anything been done to encourage a taste for music among the people. A national band so wretchedly equipped as that at the Academy is an offense against the music-loving people of the United States and a discredit to the Government. This band should be placed upon a respectable footing in its equipment, its numerical strength, and the monthly pay of its members, and this can be done at so comparatively a small addition to the present annual allowance that we are hopeful Congress will act favorably upon this recommendation. The World's Fair at Chicago will doubtless bring to our country some of the famous

bands of Europe and Spanish America, and this fact furnishes an additional reason for preparing the band at the Academy, the only distinctive band known to our military service, for presenting a creditable appearance. The band of the Academy may not be called upon to compete at Chicago with the bands of other countries, but West Point will undoubtedly be visited during the season of the fair by distinguished military, and by skillful and accomplished musicians, men from every country of the world. These men are in the habit of hearing well-equipped bands perform, and to them the Military Academy band with twenty-four pieces will present a sorry spectacle.

We believe that the bandmaster at the Military Academy should have the grade of a second lieutenant of infantry. The nature of his duties, the scientific and theoretic knowledge required, his relation to the discipline of the men under his charge, require that the position should be made one of relatively official equality with other instructors at the institution. The band should be increased to at least 40 performers, divided into two classes, and paid as much as similar talent is paid in civil life. The men should be enlisted for no other duty than that properly belonging to a band, and should be given every opportunity to exercise their professional skill not inconsistent with military discipline, as well for the benefit of the people at large as for the Government. There is no reason why West Point should not furnish trained musicians as well as trained officers for the Army, and we believe that the band at the Academy could be made to do this with very little effort and at a trifling expense above that now paid for the present band organization. If a proper organization was established the chief musicians for the Army could be drawn from the Military Academy Band, and young men could be trained at West Point to be drummers and trumpeters, and sent to regiments fully prepared to perform their duties.

If a system should be adopted such as is here outlined, the men sent to West Point for instruction in music could be utilized in the band of the Academy while undergoing instruction, and in this way that organization would gain additional numerical strength while acting as a practical school for musicians for the Army. Whether the band is or is not increased by the action of Congress, we recommend that the Secretary of War direct that all recruits for the field music of the Army enlisted within a certain radius of West Point be sent there for instruction. The advantage which would follow the establishment at West Point of a school for musicians is pointed out in a communication from Bandmaster Clappé to the secretary of the Board, which is appended to this report, and to which the attention of the Secretary of War and the Adjutant-General of the Army are invited.

The Board after fully considering this matter unanimously decided to recommend the following:

(1.) That the bandmaster be given the grade of a second lieutenant of infantry, with the pay and allowances of that grade.

(2.) That an assistant bandmaster be established to rank as a chief musician, with the pay and allowances of that grade.

(3.) That the band be increased to 40 performers, to be divided into two classes. The first class to consist of 25 performers, to be paid $40 per month each; the second class to consist of 15 performers, to be paid $30 per month each. Both classes to have the allowances now granted enlisted men.

(4) That at least 20 recruits be sent every year to West Point for instruction in music, these recruits to be retained there at least 12 months before being assigned to regiments.

The amount now annually appropriated for the pay of the band at the Academy is $9,240. Should it be increased to 40 performers, and classified as we here recommend, the annual appropriation would be $17,400, an increase of only $8,160, a very insignificant sum when the great advantages that would attend it are considered. We have no doubt that this increase would be approved by the great majority of the people.

VIEWS OF BANDMASTER CLAPPÉ.

Following is the letter addressed to the secretary of the Board by Mr. Arthur A. Clappé, teacher of music and bandmaster at the Academy:

WEST POINT, N. Y., *September* 14, 1891.

DEAR SIR: In compliance with your request I beg to submit the following suggestions and recommendations relative to the reorgaization and improvement of the U. S. Military Academy Band.

By act of Congress the band is limited to 24 musicians and 1 teacher of music. The number, aside from other considerations, is too small to produce that volume of tone necessary to distinctly mark the cadence for a body of troops on the march.

This fact is recognized on all hands, and nowhere more than among the regiments of the State National Guards. For instance, among the New York regiments the bands average a membership of 55 skilled performers. The Seventh Regiment turns out with at least 50, the Twenty-second with 65, the Seventy-first with 50, and it has been decided to increase the strength of the band of the Sixty-ninth Regiment to 65 instrumentalists. The reason of this large membership is to insure the music being heard by troops in rear of the column.

When it is remembered that usually such regiments parade in the confined thoroughfares of large cities, and that the buildings on either side, reflecting the tone, add to its volume, or at least do not permit the tone to escape, it must be admitted that the experience leading up to and compelling the support of such large musical organizations is the outcome of the positive needs of the situation, not purely ideal nor an effort for show.

If, then, it be necessary, under such circumstances and where the conditions are favorable for the propagation of sound, to have and maintain huge bands for military purposes, is it not doubly so where, as at West Point, the band, so inferior in point of numbers, invariably performs on a large open plain, where the music is diffused and lost before really achieving the purpose for which intended?

But apart from the purely military uses of the U. S. Military Academy band the artistic side of its duties, as exhibited in concerts it is called upon to perform, should be considered. It is in these performances as well as upon the parade that the band is expected to maintain the credit of the only military institution of a great country.

The only legalized and representative band of our military system should be adequate to fulfill its functions in equal degree with the leading bands of the armies of France, Germany, and England. It can not reasonably be expected to do this unless liberal provision is made for its maintenance. Although every possible effort is made to arrive at good results with the material at our disposal here, I am deeply conscious of the fact that visitors to the Academy, among whom are included ministers, military men, and persons of distinction from foreign countries, carry away with them the impression that the musical appreciation of those who legislate for the Army is of a low standard.

Though Congress has enacted that the band shall consist of 24 musicians and 1 teacher of music, the provision that divides this organization into three classes defeats the intention of the law. As an instance of this, I may state that for nearly six months two vacancies have existed in the third class, and, although numerous applications have been received from musicians seeking employment, it has been found impossible to fill them. The reason of this lies in the fact that musical services are very much better remunerated in civil life than at West Point. The pay of a third-class musician is $17 per month, with quarters and rations. He must be a poor musician, indeed, who outside can not make at least four times that amount in a month. In New York City orchestra players receive from $15 to $40 a week for their services at performances. They supplement these amounts by playing other engagements, as parades, excursions, and balls, some of which pay not less than from $5 to $7 each engagement. It will thus be apparent that we at West Point can not offer, even though all positions were paid as in the first class ($34 per month), any inducements equal to those in civil life.

If the Academy were so located that the bandsmen could secure outside playing, the case might be somewhat different; but being practically isolated these men, except on rare occasions, have but little opportunity to add to their inadequate income. This fact must be taken into account when dealing with the subject of the reorganization of the band, because the Government, seeking to employ what may be classed as skilled labor, has to face outside competition in a market where the commodity sought brings a fair and reasonable price. Where any individual is employed by the Government to perform work requiring special skill, he should be paid prices such as are paid for similar employment by private parties. If this be not done the service suffers by being intrusted to incompetent hands. This is precisely the case here. Everything of which our musicians are capable is elicited from them, yet we fall short and can not hope, under the present system, to attain results such as could be attained were we in position to offer better inducements and in return secure a better class of musicians.

I would, therefore, respectfully suggest that the U. S. Military Academy Band be reorganized so as to consist of 40 members and 1 bandmaster and 1 assistant bandmaster. The new organization should be divided into two classes as follows: 20 musicians at $34 per month, 20 at $30 per month, with privileges and allowances such as are accorded to enlisted men of the Army.

The bandmaster, as intimated above, should be accorded the status of an officer, for reasons of discipline as well as in recognition of the fact that the man who holds the position must possess superior musical attainments and socially maintain himself with proper dignity.

In addition to the foregoing I would venture to suggest that steps be taken looking to the supply of musicians and band leaders for the Regular Army from some central source, that is, from an institution under Government control. The facilities that an increased and better paid organization at West Point would afford might be turned to account in this direction. Army bands, as well as the band here, experience great difficulty in obtaining musicians to fill the constantly occurring vacancies, and, further, it frequently happens that commanding officers have to depend upon the good offices of some music-dealer when requiring a man to fill the position of band leader.

All trouble and uncertainty might be avoided by having organized in connection with the Academy band a school of instruction for military musicians. In my opinion there are many young men in the country who, having musical inclinations, would be found desirous of entering such an institution for the sake of the education afforded and who would be willing to engage to serve an enlistment in the Army which would date from the period of their transfer as a trained musician to some regiment.

But, supposing such a plan not feasible, it would still be possible to have recruits assigned from recruiting depots to undergo one year's training in music at West Point before joining regiments needing their services. If, say, twenty or more men were sent here for instruction in music from November in one year to November in the next, a source of supply would be created that would be of the greatest possible benefit to the Army and meet the warmest approval of regimental commanders and other officers. But, beyond this, provision should, in the first instance, be made for the examination of all candidates for the position of chief musician in the Army, and who could not hope to receive an appointment unless capable of undergoing the ordeal. I would, however, advise that the foregoing be only a temporary measure, and in force up to the time when Army musicians could be drawn upon to supply the material from which to train chief musicians. The course necessary to fit a man for such office would extend over a period of at least three years, that is, three years' training in the higher branches of music at the school for instruction in military music. No man should be eligible for entry who could not pass a reasonable preliminary examination and who had not served at least one enlistment in the Army.

I believe that such a system of itself would have a beneficial influence upon Army musicians, who now can not hope for promotion to the best musical position in the bands, however much they might wish to strive to attain it. Unless some such plan be adopted the present law, which permits men to retire at the expiration of practically two years and nine months, will so deplete the ranks of Army bands as to render them next to useless and make it impossible to replace the retiring members.

It occurs to me that the approaching World's Fair at Chicago might reasonably be urged to strengthen the plea for the immediate increase of the Military Academy Band.

Following the precedent of European countries, there is great probability that application will be made for permission to utilize the services of Government bands. Already rumors are current that negotiations are in progress to bring over the foremost and representative army bands of Europe. In event of such a movement being successful, our bands would cut a sorry figure by comparison, unless the work be at once commenced of building them up to a higher degree of perfection, and such as to enable them to creditably represent the musical status of the country.

Yours, respectfully,

ARTHUR A. CLAPPÉ,
Teacher of Music, U. S. Military Academy.

Maj. JOHN M. CARSON,
Secretary Board of Visitors, U. S. Military Academy.

VIEWS OF BANDMASTER SOUSA.

The U. S. Marine Band is similarly situated to the Military Academy Band, except that the former has forty performers. At the last session of Congress the Committee on Naval Affairs reported a bill to increase the numerical strength of the Marine Band and to put it upon a footing which an organization of this character deserves. The bill was approved by the Secretary of the Navy, who addressed a letter to the chairman of the Committee on Naval Affairs, inclosing with approving

comments a letter from Bandmaster John Philip Sousa, in which urgent reasons were given for the reorganization of the Marine Band. These reasons are pertinent in the case of the Military Academy Band, and we therefore produce in this report Bandmaster Sousa's letter:

WASHINGTON, D. C., *December* 17, 1890.

SIR: I have the honor to submit, in conjunction with the draft of a bill for the reorganization of the band of the United States Marine Corps, the following statement explaining the reason why the band should be placed on a proper and equitable basis with other famous bands. The leading government bands of the nations of the Old World, notably the Garde Républicaine, the Prussian Guards, the Seventy-third Austrian, the Russian Mounted Guards, the Grenadier Guards, and others, number from 50 to 90 men each. The Mexican National Band, which made a tour of the United States a few years since, comprises nearly 90 musicians, and I am informed that many of the South American governments have bands consisting of 60 to 80 pieces. Even Japan and Turkey have well-equipped bands, based on modern instrumentation. Many of the orchestral bands of Europe have a membership of at least 100, while Lamoureux, of Paris, numbers 110.

Among the militia bands of our land, Gilmore is allowed by regimental regulations 65 musicians, and many others have from 50 upwards. The large factories of America have bands numbering from 30 to 75 performers. These bands are sustained by hiring musicians to perform some light employment in the factory and allowing them to accept musical engagements whenever offered. Among the well-known organizations of this class may be mentioned the Elgin Watch Company's, the Pullman Car Company's bands. The men constituting the membership in the factory bands are assured a livelihood throughout the year and receive wages largely in excess of that paid by the Government to its musicians. Where formerly we could recruit our members from musical talent of that class, the supply is almost entirely shut off, for of course nearly every man would prefer employment in a factory at $2, $3, or $4 a day with opportunities of following his profession, and thus adding largely to his income, rather than becoming an enlisted man at $13 to $38 per month, with few opportunities of adding to his governmental compensation.

Another and much greater competitor in bidding for the musician's services is the theatrical manager. He pays salaries varying from $15 to $42 per week to the rank and file of the profession, and with very few exceptions allows his musicians to send substitutes when a more profitable engagement is offered. During the summer months the myriad of watering places create a great demand for the musician's services, and he is in nearly every instance well paid. When it is understood that theatrical musicians are employed but a few hours during the evening, and with the exception of Monday morning and Saturday afternoon have the entire week to pursue their calling elsewhere, it is not to be wondered that we find it difficult to secure and keep suitable material for our organization. Dime museum and variety hall managers here pay their musicians $15 per week; the Government pays musicians of the same skill about that per month. Grand opera orchestral players receive about $40 a week; our soloists receive about that sum per month. The theatrical and comic opera managers pay their conductors from $120 to $450 a month; the United States pays the bandmaster of the Marine Band $94 per month, with 13 cents a day added for commutation of rations. The Twenty-second Regiment of New York pays Mr. Gilmore a personal salary of $2,500 a year, for which in return he gives about two weeks of his time. The Boston Symphony Orchestra pays their conductor a salary of over $2,000 a month; the proposed reorganization does not ask the Government to pay the bandmaster of the Marine Band that much a year.

The city of New York appropriates $25,000 every year for open air band concerts during the summer months. In proportion not one-half that amount is asked for our

d, virtually the national band, and the band that should be as great among bands merica is great among nations.

I beg to present the commercial side of the question: The present duty on musical merchandise and books, based on the value of imports of former years, amounts to between $800,000 and $900,000 a year. Business men assert that it is good policy to spend a dollar to make a dollar, and if our legislators hesitate to spend Government money for music, the art, they should in all fairness spend it for music, the business.

There can be little doubt but that the professional musician creates the demand for musical literature and musical merchandise. Were it not for him the national revenue would lose that amount. As a plain business proposition it is but reasonable to assume that the Government should use a portion of this large sum in further developing the musical culture and musical resources of our land. No better way can be devised than by proper equipment of the musical bodies in its employ, and especially the organization that represents it musically on official occasions. Begging your earnest consideration for this measure, and requesting that you will favorably recommend it to Congress, I am,

Very respectfully,

JOHN PHILIP SOUSA,
Bandmaster United States Marine Corps.

The SECRETARY OF THE NAVY.

GYMNASTIC INSTRUCTION AND EXERCISES.

The calisthenic exercises by the fourth class was an exceedingly interesting and creditable exhibition, in which the entire membership of the class participated. The performances, in addition to contests with foils, broadswords, and bayonets, included all exercises taught in the gymnasium. Considering that the participants had but 9 months of instruction a wonderful degree of efficiency was shown, and in view of the fact that the equipment of the gymnasium at the Academy, both as regards building and paraphernalia, is very limited, special credit is due Mr. Herman Koehler, who has charge of this department. This gentleman is an able and accomplished instructor, and performs an amount of labor that challenges admiration. In addition to his duties in the gymnasium he is master of the sword, and teacher of swimming and dancing, the last being taught the cadets of the first year in order to give grace and ease to their movements. All this labor is performed alone by Mr. Kœhler, and the entire fourth class, generally numbering over 100 members, are his pupils. An act should be passed conferring upon Mr. Koehler the assimilated rank of second lieutenant of infantry, and he should be given an assistant. The leading colleges of the country recognize the importance and value of physical training, and many of them have made those in charge of this branch of instruction members of the faculty.

The great efficiency of Mr. Kœhler's services is attested by the performances of his pupils, and their value is exhibited by the muscular and well-developed limbs and bodies of the cadets who have been under his instruction for 9 months of the first year at the Academy. The conferring of rank upon this accomplished instructor would be not only a proper recognition of his services, and the means of attaching him permanently to the Academy, but would add to his efficiency, because at a strictly military school like that at West Point, rank and authority

must be synonymous in order to promote and maintain thorough discipline. The academic board is unanimous in the opinion that the instructor in calisthenics and the sword should have the rank of second lieutenant, and recommendations to this effect have been made by the Superintendent and by former Boards of Visitors. We earnestly renew this recommendation. We also join in the recommendation heretofore made that an assistant instructor of gymnastics be provided. These two objects could be accomplished at the coming session of Congress by a paragraph in the Military Academy appropriation bill. The new gymnasium building will be ready for occupation in the spring of 1892, and it is to be hoped that Congress will liberally provide for its proper equipment, and make it what such a department at the United States Military Academy should be.

In the opinion of the Board it is a mistake not to continue the instruction in gymnastics beyond the first year. We realize that this could not heretofore be done to any extent, with the limited resources of the old building devoted to this class of instruction, and with the poverty of equipment which has been heretofore provided. But when the new gymnasium building is completed and thoroughly equipped, we recommend that steps be taken to have this class of instruction continued throughout the 4 years.

PORTRAIT GALLERY IN GRANT HALL.

Several years ago, through the generosity of Mr. George W. Childs, of Philadelphia, who donated oil portrails of Generals Grant, Sherman, and Sheridan, a portrait gallery was started of distinguished graduates of the Academy. The three portraits alluded to were hung in Grant Hall, and formed the nucleus of what has become a very valuable collection of paintings of men who achieved distinction in the military service of the United States. Several portraits which had been previously donated to the Academy, and which were hanging in the Library, were transferred to Grant Hall, and additions have been made from time to time to the collection through the generosity of friends and relatives of distinguished alumni. This collection now numbers seventeen valuable oil portraits, all of which are hanging in the hall in which the cadets daily assemble three times each day for meals. It is to be hoped that this collection will receive other additions, and that before long the portraits of Hancock, Thomas, McPherson, Canby, and other distinguished soldiers will be found on the walls of Grant Hall. Following is a list of the portraits now at the Academy:

(1) Maj. Gen. JOHN F. REYNOLDS.—Presented by the First Corps, Army of the Potomac. Members of the committee on presentation: Gen. R. Coulter, Gen. C. S. Wainwright, Col. Chapman Biddle, and Col. Thomas Hewson Bache. Painted by Alexander Lawrie. Received November, 1878.

(2) Maj. Gen. JOHN SEDGWICK.—Purchased. Painted by H. Balling, 1864. Received February, 1870.

(3) Col. JOHN J. ABERT, Chief of Topographical Engineers.—Presented by ———. Painted by ———. Received ———.

(4) Maj. Gen. JOHN M. SCHOFIELD.—(*Superintendent's Portrait.*) Painted by J. Carroll Beckwith. Received May, 1880.

(5) Gen. ULYSSES S. GRANT.—Received June 1, 1887.

(6) Gen. WILLIAM T. SHERMAN.—Received June, 1889.

(7) Gen. PHILLIP H. SHERIDAN.—Received June, 1889. Presented by George W. Childs, Philadelphia, Pa. Painted by Mrs. L. H. Darragh. Unveiled with appropriate ceremonies, October, 1889.

(8) Maj. Gen. EDWARD O. C. ORD.—Presented by Dr. Ord, of Washington, D. C., to the Alumni Association. Painted by ———. Received March, 1885.

(9) Brig. Gen. WESLEY MERRITT.—(*Superintendent's Portrait.*) Painted by J. Carroll Beckwith, 1887. Received February, 1887.

(10) Capt. BRADFORD R. ALDEN. (*Commandant of Cadets*, 1848 *to* 1852.) Presented by Mrs. B. R. Alden. Painted by John F. Weir, 1887. Received July 30, 1887.

(11) Bvt. Maj. Gen. GOUVERNEUR K. WARREN.—Presented by Messrs. Joseph Choate, James C. Carter, James J. Higginson, and other gentlemen of New York City, and friends in Newport, R. I., through Mr. Robert Stickney. Painted by Alexander Lawrie. Received December, 1889.

(12) Bvt. Maj. Gen. THOMAS SWORDS (*Colonel and Assistant Quartermaster General*), *as he appeared when captain of the First Dragoons.*—Presented by Mrs. Thomas Swords (through her sister, Ellen H. Cotheal). Painted by ———. Received August, 1890.

(13) Maj. Gen. GEORGE G. MEADE.—Presented by Henry Carey Baird, of Philadelphia. Painted by T. Henry Smith, 1890. Received May 23, 1891.

(14) BVT. MAJ. GEN. ROBERT O. TYLER, *Lieutenant-Colonel and Deputy Quartermaster-General.*—Presented by his brother, E. S. Tyler, of Hartford, Conn. Painted by W. R. Wheeler, 1875. Received September, 1890.

(15) Col. JAMES GILCHRIST BENTON.—Presented by Mr. William Seward Webb, of New York City. Painted by J. Carroll Beckwith. Received June, 1891.

(16) Maj. Gen. JAMES BREWERTON RICKETTS.—Presented by Benjamin W. Richards, of Philadelphia, Pa. Painted by Robert Hinckley, of Washington, D. C. Received June, 1891.

(17) Maj. Gen. GEORGE B. MCCLELLAN.—Presented by General E. Burd Grubb, of New Jersey. Painted by Anthony Lamore. Received June, 1891.

THE GRADUATION EXERCISES.

The graduation exercises were held on the green in front of the chapel on the morning of June 12, in presence of a large audience. Colonel Wilson, the Superintendent of the Academy, presided. Following was the programme of exercises.

1. The graduating class will proceed to the designated place escorted by the Corps of Cadets, under the command of the commandant of cadets.
2. Prayer.
3. Music: U. S. Military Academy band.
4. Address to graduating class: Hon. Julius C. Burrows, M. C., Board of Visitors.
5. Music: U. S. Military Academy band.
6. Delivery of Diplomas: Hon. Redfield Proctor, Secretary of War.
7. Remarks: Rev. Frank O'Brien, Board of Visitors.
8. Music: U. S. Military Academy band.
9. Benediction.

The Board directed that the address of Mr. Burrows to the graduating class should be printed as part of the report. Upon being introduced by Colonel Wilson, Mr. Burrows said:

ADDRESS OF HON. JULIUS C. BURROWS.

Gentlemen of the graduating class of '91: Knowing and appreciating how impatient you are to be released, I shall not long restrain you from the full fruition of your desires. After four years of patient application you have successfully completed the prescribed course of instruction at this National Military Academy, and you are soon to be assigned to duty with the Army of the United States. Thus far the Government has served you; you must now serve the Government.

If you have availed yourselves of the advantages which this institution has afforded for scholastic and soldierly training, you are amply equipped for the service upon which you are about to enter. At this juncture in your career, in this supreme moment of your life, there is a single thought uppermost in my own mind, which I would be glad to so impress upon you as to secure for it a permanent lodgment in your hearts in the hope and belief that it will serve to dignify and exalt the profession you have espoused, and to which you have dedicated your lives.

You will go to your posts of duty in a time of profound peace. The nation is at peace with all the world. There is neither "war nor rumors of war." All causes of internal dissension are forever removed, and fratricidal war will never again distract or divide this happy, reunited people. It is not improbable, therefore, that you may never be called upon to put the knowledge you have here acquired to the practical and crucial test of actual war.

With this prospect before you, the thought I would impress upon you is this: That faithful and efficient service in the Army of the United States in times of peace is as important to the Government and as honorable to the soldier as when rendered in the midst of actual hostilities.

The accomplished Superintendent of this Academy, together with its efficient corps of instructors in military science; you who go to your commands to impart to others something of the military skill and soldierly training which you have here acquired; the lone sentinel who walks his midnight beat, under the silent stars, with no foe to answer his stern challenge; all these render a service to the country of as inestimable value as those who lead armies and fight battles. It has been said that "peace hath her victories no less renowned than war." The triumphs of armies

are not recorded alone on battlefields. Armies win victories in peace as well as in war. The silent majesty of a nation's military and naval power in peace, fully disciplined and equipped, is as potent for the public weal as when marshaled on hostile fields. A nation prepared for war holds the bond of every other nation to keep the peace.

I would have you understand, therefore, that though the Government may never require your services in actual war, yet in making choice of the profession of arms you have identified yourself with an important, and I may say an indispensable, function of civil government. A military power in peace is as essential to government as the legislative, executive, or judicial power. A government without force is as impossible as a government without law. There is no nation on the face of the globe, democratic or despotic, that has not at ready command armies and navies to enforce its sovereign decrees. The presence of such a power is the heart-beat of a nation's life. Disband the armies, dismantle the navies of the nations of the world and governments would perish and civilization decay. If, therefore, in years to come you may sometimes weary of the endless monotony of camp life in peace, these reflections may inspire you to renewed zeal and fresh courage.

But you may say, "Is there nothing before me but this endless routine of camp life and duty? Are there no campaigns to be prosecuted or battles fought except imaginary ones? Are sentinels to be posted, pickets thrown out, skirmishers deployed, lines of battle formed, charges made, sieges prosecuted, pontoons laid, cities bombarded, and fortresses stormed only in mimicry of war?" Possibly that is all, but if all, it is sufficient to fill the measure of a soldier's laudable ambition. It is the disciplined army in peace that makes the invincible army in war.

The purpose of the Government in founding this institution was to give to those who entered it not only an opportunity to acquire such knowledge of military science as might enable them to serve the Government in war, but in peace to impart to the recruited army of the United States something of that discipline and soldierly spirit without which armies are mobs and battles butcheries. Congress has testified its appreciation of the disciplinary service by placing the additional incentive of personal advancement, as a reward for superior attainment, in authorizing the President of the United States to prescribe a system of examination of all officers in the Army below the rank of major to determine their fitness for promotion. If the officer fails in such examination and is reported unfit for promotion, the officer next below him in rank (if passing) shall receive the promotion. The officer failing, if for physical reasons, shall be retired. If for other reasons, he shall be suspended for promotion for the period of one year, at the expiration of which time he shall be reëxamined, and if upon such reëxamination he shall again be found unfit for promotion, he shall be discharged from the Army of the United States. Heretofore promotions have had to wait on death or resignation; hereafter they will come as a reward for superior attainments. Every consideration therefore of public duty and personal pride conspire to stimulate you to the highest possibilities of your profession.

Go, therefore, gentlemen, to your posts of duty. Take with you the strict discipline, the high sense of honor, the soldierly bearing, and the love of country which this institution has sought to inculcate, and not only treasure them as the priceless jewels of a soldier's life, but by precept and example inspire their acquisition in others. And above all else venerate the flag of your country as you do the altar of your religion. It is a memory and a hope. Morning and evening salute it, and as the rising and setting sun lights up its glories, with uncovered head swear renewed and eternal allegiance to this symbol of a nation's sovereignty. Senator Manderson, as I rose to address you, related an incident which once came under his observation. Seated in a great assemblage, the band struck up "God save the Queen," and instantly every Englishman present sprang to his feet and reverently stood during the rendition of this national invocation. Let us imitate that spirit, and not only salute the flag, but

when the music of our national airs falls upon the ear, let every soldier and citizen rise in patriotic recognition of its inspiring strains.

Go then to your posts of duty, and, though peace smiles continually upon the land, serve the country with the same fidelity as if involved in war. And though your names may never be sounded in the trumpet of fame, chiseled in marble, or cut in brass, yet you will have the consolation of knowing that you have desolated no homes, made no graves, and broken no human hearts; and your enduring monument will be blossoming fields, happy homes, and the plaudits of a free people reposing in security and peace behind the bulwark of a disciplined, patriotic, and invincible Army.

ADDRESS BY HON. REDFIELD PROCTOR, SECRETARY OF WAR.

Upon the conclusion of Mr. Burrows's address and the performance of an appropriate air by the Military Academy Band each member of the graduating class was called to the platform by the Superintendent and handed his diploma by the Secretary of War. The diplomas having been distributed, the Secretary addressed the assembly as follows:

Colonel Wilson, cadets, ladies, and gentlemen: I am sure one thought occurs to all of us to-day. We miss a familiar face and voice from this platform, the face and voice of one we all respected, admired, and loved. It rarely falls to the lot of any man to fill so large a space in the minds and hearts of his countrymen as did General Sherman. And I could not by any elaborate speech say anything better to you young soldiers than simply to commend the life of this great soldier and citizen as one in every way worthy of study and imitation. His career as a soldier is too familiar to you all for any review, but in our admiration of his great soldierly qualities we may lose sight of another side of his character. It may fairly be said of him that he was a great statesman and politician, in the best sense of the term, and in support of this statement I need only refer to the masterly manner in which he handled the many questions which came before him, more or less relating to statecraft and politics, and often requiring immediate action.

The soldier is freed by the character and conditions of the service from most of the ordinary political obligations of free men. But you are nevertheless citizens and sovereigns of a free country as well as soldiers. You are not free. No man is free from the duty of studying and understanding the political system under which he lives. Every man may have fixed political ideas and principles and be ready to act upon them when occasion demands. He is as much bound to understand and do his duty in political affairs as he is to deal honestly by his neighbor or perform any of the obligations of good citizenship.

General Sherman's political platform was short, a model in that respect, and I know it will commend itself to you and trust it will henceforth to all within our borders. He stated these principles many times, notably when he left the school in Louisiana, in January, 1861, in a letter to Governor Moore, of that State, in which he said: "On no earthly account will I do any act or think any thought hostile to or in defiance of the whole Government of the United States. I prefer to maintain my allegiance to the Constitution as long as a fragment of it survives." He set another good example to the politicians, for he always lived up to his platform. He kept in mind the safe general rule that the National Government has, and must have, all the powers necessary for its preservation, the maintenance of its authority, and the honor of its flag. I know that this emblem, so faithfully and ably guarded by him, is safe in your hands.

ADDRESS OF REV. FRANK A. O'BRIEN.

The Rev. Frank A. O'Brien followed Secretary Proctor, making a short address to the graduating class, concluding his remarks by saying:

We are standing and will stand before the world as we make ourselves with the use of God's gifts. It is enough to have done our duty whether it brings cross or crown. Be bold and confident. Work for the cause of truth, of justice, and for that great gift of freedom. We need our best men in the thickest of the fight. Honesty, intelligence, and independence in public life will be the glory of the longest day. Intrigue, deceit, and treachery may rule the shorter hours; but its sundown is darkness. Let your motto be the watchword of our country—"In God we trust." In the words of Mother Church let me conclude by saying: "Gallant Knight, receive your honors. Go forth to battle. May you always know the just cause, have courage to espouse it, and strength of arm and tongue and pen to ever lead it to victory."

MEMBERS OF THE CLASS OF 1891.

Following is the list of the graduating class:

Order of general merit.	Name.	Where born.	Appointed from.	Order of general merit.	Name.	Where born.	Appointed from.
*1	Crosby, Spencer	Md	At large.	34	Hirsch, Harry J	Pa	Pa.
*2	Sewell, John S	Tenn	Ky.	35	Hine, Charles De L	Va	Va.
*3	Echols, Charles P	Ala	Ala.	36	Frazier, Joseph	Mo	Mo.
*4	McIndoe, James F	Md	Md.	37	Hamilton, Robert L	W. Va	W. Va.
*5	Morrow, Jay J	W. Va	Pa.	38	Upton, LaRoy S	Mich	Mich.
6	Horney, Odus C	Ill	Ohio.	39	Smith, Harry A	Kans	Kans.
7	Lyon, LeRoy S	Va	Va.	40	Clark, Hollis C	Ill	N. Y.
8	Hero, Andrew, jr	La	La.	41	Saffarrans, George C	Tenn	Ky.
9	Horn, Tiemann N	N. Y.	N. J.	42	Pierce, Palmer E	Ill	Iowa.
10	Anderson, Edward D	Tenn	Tenn.	43	Wahl, Lutz	Wis	Wis.
11	Murphy, Truman O	Ohio	Ohio.	44	Jackson, William P	Mo	Mo.
12	White, George P	Minn	Iowa.	45	Donworth, Albert B	Me	Me.
13	Fuller, Lawson M	Wis	Wis.	46	Ogden, Charles C	Ind	Ill.
14	Scherer, Louis C	Minn	Minn.	47	Voorhies, Gordon	Ky	Ky.
15	Furlong, John W	N. J	Pa.	48	Hines, John L	W. Va	W. Va.
16	Livermore, Richard L	N. Y.	N. J.	49	Smith, Guy H. B	Mich	Md.
17	Corcoran, Thomas M	Mass	Mass.	50	Whitman, Walter M	N. Y.	N. Y.
18	Fleming, Robert J	Ireland	Mich.	51	Crowley, Matthias	Ireland	N. Y.
19	Winans, Edwin B., jr	Mich	Mich.	52	g Lafitte, Jacques de L	La	La.
20	Johnston, William T	Pa	Mo.	53	Bradley, John J	Ill	Ill.
21	Osborne, William H	Pa	Pa.	54	Settle, Douglas	N. C	N. C.
22	Schoeffel, Francis H	N. Y.	N. Y.	55	Switzer, John S	Pa	Pa.
23	Howard, Harold P	Minn	Minn.	56	Williams, Herbert O	Miss	Miss.
24	Bertsch, William H	Mich	Mich.	57	Guyer, George D	N. Y.	N. Y.
25	Bush, Ross L	Ill	Ill.	58	Grote, William F	Ill	Ill.
26	Donovan, Joseph L	Ky	Ky.	59	Chapman, William H. H	Wis	Wis.
27	Lindsley, Elmer	N Y	N. Y.	60	Royden, Herbert N	Conn	Conn.
28	Bennet, John B	N. J	Colo.	61	Jenks, Isaac C	Mass	Mass.
29	Crabbs, Joseph T	Ind	Ill.	62	Drew, Alfred W	Tex	Tex.
30	Glasgow, William J	Mo	Mo.	63	Ely, Hanson E	Iowa	Iowa.
31	Armstrong, Frank S	Ind	Ind.	64	Sorley, Lewis S	England	Tex.
32	Jarvis, Melville S	W. Va	W. Va.	65	Cordray, David P	Ohio	Ohio.
33	Heavey, John W	Ill	Ill.				

APPOINTMENT AND ADMISSION OF CADETS.

The following is a copy of the circular issued by the War Department, furnishing all necessary information relative to the appointment and admission of cadets to the U. S. Military Academy.

APPOINTMENTS.

How made.—Each Congressional district and Territory—also the District of Columbia—is entitled to have one cadet at the Academy. Ten are also appointed *at large.* The appointments (except those *at large*) are made by the Secretary of War at the request of the Representative or Delegate in Congress from the district or Territory; and the person appointed must be an actual resident of the district or Territory from which the appointment is made. The appointments *at large* are especially conferred by the President of the United States.

Manner of making applications.—Applications can be made at any time, by letter to the Secretary of War, to have the name of the applicant placed upon the register, that it may be furnished to the proper Representative or Delegate when a vacancy occurs. The application must exhibit the full name, date of birth, and permanent abode of the applicant, with the number of the Congressional district in which his residence is situated.

Date of appointments.—Appointments are required by law to be made one year in advance of the date of admission, except in cases where, by reason of death or other cause, a vacancy occurs which can not be provided for by such appointment in advance. These vacancies are filled in time for the next annual examination.

Alternates.—The Representative or Delegate in Congress may nominate a legally qualified second candidate, to be designated the *alternate.* The alternate will receive from the War Department a letter of appointment, and will be examined *with the regular appointee,* and if fully qualified will be admitted to the Academy in the event of the failure of the principal to pass the prescribed preliminary examinations. The alternate will not be allowed to defer his reporting at West Point until the result of the examination of the regular appointee is known, but must report at the time designated in his letter of appointment. The alternate, like the nominee, should be designated as nearly one year in advance of date of admission as possible.

ADMISSION OF CADETS.

A candidate, upon receiving his conditional appointment, is ordered to report at West Point to the Superintendent of the Military Academy in time to appear before the Academic Board for examination at its meeting early in June, unless there be good reasons for designating another time.

The candidate, soon after his arrival at West Point, is subjected to a rigid physical examination by a board of experienced surgeons of the Army. If he passes successfully this examination, he is then examined by the Academic Board. These examinations are made with as little delay as practicable after the candidate reports to the Superintendent.

The candidate who passes successfully these examinations is admitted at once to the Academy without returning to his home. Immediately after his admission, and before receiving his warrant of appointment, he is required to sign an engagement for service in the following form, in the presence of the Superintendent or of some officer deputed by him:

I, ——— ———, of the State (or Territory) of ———, aged ——— years ——— months, do hereby engage (with the consent of my parent or guardian) that, from the date of my admission as a cadet of the United States Military Academy, I will serve in the Army of the United States for eight years, unless sooner discharged by competent authority.

———— ————.

In the presence of—

———— ————.

The candidate is then required to take and subscribe an oath or affirmation in the following form:

"I. ——— ———, do solemnly swear that I will support the Constitution of the States, and bear true allegiance to the National Government; that I will

maintain and defend the sovereignty of the United States, paramount to any and all allegiance, sovereignty, or fealty I may owe to any State or country whatsoever; and that I will at all times obey the legal orders of my superior officers, and the rules and articles governing the armies of the United States.

Sworn and subscribed, at ———, this ——— day of ———, eighteen hundred and ———, before me.

———— ————.

———— ————.

Qualifications.—The age for the admission of cadets to the Academy is between seventeen and twenty-two years. Candidates must be unmarried, at least five feet in height, free from any infectious or immoral disorder, and, generally, from any deformity, disease, or infirmity which may render them unfit for military service. They must be well versed in reading, in writing, including orthography, in arithmetic, and have a knowledge of the elements of English grammar, of descriptive geography (particularly of our own country), and of the history of the United States.

CHARACTER OF EXAMINATIONS.*

* It is suggested to all candidates for admission to the Military Academy that, before leaving their place of residence for West Point, they should cause themselves to be thoroughly examined by a competent physician, and by a teacher or instructor in good standing. By such an examination any *serious* physical disqualification or deficiency in mental preparation would be revealed, and the candidate probably spared the expense and trouble of a useless journey and the mortification of rejection.

It should be understood that the informal examination herein recommended is solely for the convenience and benefit of the candidate himself, and can in no manner affect the decision of the Academic and Medical Examining Boards at West Point.

PHYSICAL EXAMINATION.

Every candidate is subject to a rigid physical examination, and if there is found to exist in him any of the following causes of disqualification to such a degree as would immediately, or at no very distant period, impair his efficiency, he is rejected:

1. Feeble constitution and muscular tenuity; unsound health from whatever cause; indications of former disease; glandular swellings or other symptoms of scrofula.
2. Chronic cutaneous affections, especially of the scalp.
3. Severe injuries of the bones of the head; convulsions.
4. Impaired vision, from whatever cause; inflammatory affections of the eyelids; immobility or irregularity of the iris; fistula lachrymalis, etc., etc.
5. Deafness; copious discharge from the ears.
6. Loss of many teeth, or the teeth generally unsound.
7. Impediment of speech.
8. Want of due capacity of the chest, and any other indication of a liability to a pulmonic disease.
9. Impaired or inadequate efficiency of one or both of the superior extremities on account of fractures, especially of the clavicle, contraction of a joint, extenuation, deformity, &c.
10. An unusual excurvature or incurvature of the spine.
11. Hernia.
12. A varicose state of the veins of the scrotum or spermatic cord (when large), sarocele, hydrocele, hemorrhoids, fistulas.
13. Impaired, or inadequate efficiency of one or both of the inferior extremities on account of varicose veins, fractures, malformation (flat feet, etc.), lameness, contraction, unequal length, bunions, overlying or supernumerary toes, etc., etc.
14. Ulcers, or unsound cicatrices of ulcers likely to break out afresh.

* NOTE.—There being no provision whatever for the payment of the traveling expenses of either accepted or rejected candidates for admission, no candidate should fail to provide himself in advance with the means of returning to his home, in case of his rejection before either of the examining boards, as he may otherwise be put to considerable trouble, inconvenience, and even suffering on account of his destitute condition. If admitted, the money brought by him to meet such a contingency can be deposited with the treasurer on account of his equipment as a cadet, or returned to his friends.

ACADEMICAL EXAMINATION.

Reading.—In reading, candidates must be able to read understandingly, with proper accent and emphasis.

Writing and Orthography.—In writing and orthography they must be able, from dictation, to write sentences from standard pieces of English literature, both prose and poetry, sufficient in number to test their qualifications, both in handwriting and orthography.

Arithmetic.—In arithmetic they must be able—

(1) To explain, accurately and clearly, its objects and the manner of writing and reading numbers—entire, fractional, compound, or denominate;

(2) To perform, with facility and accuracy, the various operations of addition, subtraction, multiplication, and division of whole numbers, abstract and compound or denominate, giving the rule for each operation, with its reasons, and also for the different methods of proving the accuracy of the work;

(3) To explain the meaning of reduction—its different kinds, its application to denominate numbers in reducing them from a higher to a lower denomination and the reverse, and to equivalent decimals; to give the rule for each case, with its reasons, and to apply readily these rules to practical examples of each kind;

(4) To explain the nature of prime numbers, and factors of a number—of a common divisor of two or more numbers, particularly of their greatest common divisor—with its use, and to give the rule, with its reasons, for obtaining it; also the meaning of a common multiple of several numbers, particularly of their least common multiple and its use, and to give the rule, with its reasons, for obtaining it, and to apply each of these rules to examples;

(5) To explain the nature of fractions, common or vulgar, and decimal—to define the various kinds of fractions, with the distinguishing properties of each—to give all the rules for their reduction, particularly from mixed to improper and the reverse—from compound or complex to simple—to their lowest terms—to a common denominator—from common to decimal and the reverse; for their addition, subtraction, multiplication, and division, with the reasons for each change of rule, and to apply each rule to examples;

(6) To define the terms ratio and proportion—to give the properties of proportion and the rules, and their reasons, for stating and solving questions in both simple and compound proportion, or single and double rule of three, and to apply these rules to examples;

(7) The candidates must not only know the principles and rules referred to above, but they are required to possess such a thorough understanding of all the fundamental operations of arithmetic as will enable them to combine the various principles in the solution of any complex problem which can be solved by the methods of arithmetic. In other words, they must possess such a complete knowledge of arithmetic as will enable them to take up at once the higher branches of mathematics without further study of arithmetic;

(8) It is to be understood that the examination in these branches may be either written or oral, or partly written and partly oral—that the definitions and rules must be given fully and accurately, and that the work of all examples, whether upon the blackboard, slate, or paper, must be written plainly and in full, and in such a manner as to show clearly the mode of solution.

Grammar.—In English grammar candidates must be able—

(1) To define the parts of speech and give their classes and properties; to give inflections, including declension, conjugation, and comparison; to give the corresponding masculine and feminine gender nouns; to give and apply the ordinary rules of syntax.

(2) To parse fully and correctly any ordinary sentence, omitting rules, declensions, comparisons, and principal parts, but giving the subject of each verb, the governing word of each objective case, the word for which each pronoun stands or to which it

refers, the words between which each preposition shows the relation, precisely what each conjunction connects, what each adjective and adverb qualifies or limits, the construction of each infinitive, and, generally, showing a good knowledge of the function of each word in the sentence. Omissions will be taken to indicate ignorance.

(3) To correct in sentences or extracts any ordinary grammatical errors, such as are mentioned and explained in ordinary grammars.

It is not required that any particular grammarian or text-book shall be followed; but rules, definitions, parsing, and corrections must be in accordance with good usage and common sense. The examination may be written or oral, or both written and oral.

Geography.—Candidates will be required to pass a satisfactory examination, written or oral, or both, in geography, particularly of our own country. To give a candidate a clear idea of what is required, the following synopsis is added to show the character and extent of the examination. Questions are likely to be asked involving knowledge of—

(1) Definitions of the geographical circles, of latitude and longitude, of zones, and of all the natural divisions of the earth's surface, as islands, seas, capes, etc.

(2) The continental areas and grand divisions of the water of the earth's surface.

(3) The grand divisions of the land—the large bodies of water which in part or wholly surround them:

Their principal mountains, location, direction, and extent; the capes, from what parts they project and into what waters.

Their principal peninsulas, location, and by what waters are they embraced.

The parts connected by an isthmus, if any.

Their principal islands, location, and surrounding waters.

The seas, gulfs, and bays, the coasts they indent, and the waters to which they are subordinate.

The straits, the lands they separate and the waters they connect.

Their principal rivers, their sources, directions of flow, and the waters into which they empty.

Their principal lakes, location, and extent.

(4) The political divisions of the grand divisions:

Their names, locations, boundaries, and capitals; general questions of the same character as indicated in the second section made applicable to each of the countries of each of the grand divisions.

(5) The United States.

The candidate should be thoroughly informed as to its general features, configuration, location, and boundaries (both with respect to neighboring countries, and latitude and longitude); its adjacent oceans, seas, bays, gulfs, sounds, straits, and islands; its mountain ranges, their location and extent; the sources, directions, and terminations of the important rivers and their principal tributaries; the lakes; and in short, every geographical feature of the country as indicated above. The location and termination of important railroad lines and other means of communication from one part of the country to another should not be omitted.

The States and Territories are to be accurately located with respect to each other by their boundaries, and as to their order along the Atlantic coast, the Gulf of Mexico, the Pacific coast, the Northern frontier, the Mexican frontier, and the Mississippi, Missouri, and Ohio Rivers.

The boundary and other large rivers of each State as well as all other prominent geographical features should be known.

The names and locations of their capitals, and other important cities and towns are likewise to be known.

In short, the knowledge should be so complete that a clear mental picture of the whole or any part of the United States is impressed on the mind of the candidate. More weight is attached to a knowledge of the geography of the United States than that of all other countries combined.

History.—The candidate should make himself familiar with so much of the History of the United States as is contained in the ordinary school histories. The examination may be written or oral, or partly written and partly oral, and will usually consist of a series of questions similar to the following:

I. Name the earliest European settlements within the present limits of the United States—when, where, and by whom made? When did the settlements made by other nations than the English come under the Dominion of Great Britain, and of the United States?

II. What was the difference between the royal, the chartered, and the proprietary colonies? How many colonies were there originally in Massachusetts and Connecticut? When were they united? How many in Pennsylvania? When were they separated?

III. In what wars were the colonies engaged before the Revolution? What were the principal events and results of those of King William, Queen Anne, King George, and the French and Indians?

IV. What were the remote and the immediate causes of the American Revolution? Explain the navigation act, the stamp act, writs of assistance. When did the war of the revolution properly begin? When, where, and how did it end? Give the particulars of Arnold's treason. Who were the most prominent generals in this war? Name the most important battles, and their results.

V. The Constitution of the United States—why and when was it formed? When was it adopted?

VI. Give the names of the Presidents of the United States in their order. Give the leading events of the administration of each one; for example, that of—

WASHINGTON.—Indian war; trouble with France; Jay's treaty; the whisky rebellion, etc.

JEFFERSON.—War with Tripoli; purchase of Louisiana; the embargo, etc.

MADISON.—War of 1812; its causes, the principal battles on land and sea, peculiarity of its last battle, when ended, etc.

MONROE.—Indian war; cession of Florida; Missouri compromise, etc.

JACKSON.—Black Hawk and Seminole wars; the United States Bank; nullification, etc.

POLK.—The Mexican war; its causes, principal battles, result of it, etc.

PIERCE.—Repeal of Missouri compromise; troubles in Kansas, etc.

BUCHANAN.—Civil war; how begun, etc.

LINCOLN.—War of secession; its causes; its results, social and political; explain doctrine of State sovereignty; alienation between Northern and Southern States; doctrine of secession; give an account of principal battles.

JOHNSON.—Fourteenth amendment; tenure-of-office bill; Johnson's impeachment.

GRANT.—Fifteenth amendment; Alabama claims and treaty of Washington; electoral commission.

ACADEMIC DUTIES.

The academic duties and exercises commence on the 1st of September and continue until the 1st of June. Examinations of the several classes are held in January and June, and, at the former, such of the new cadets as are found proficient in studies and have been correct in conduct are given the particular standing in their class to which their merits entitle them. After each examination cadets found deficient in conduct or studies are discharged from the Academy, unless the Academic Board for special reasons in each case should otherwise recommend. Similar examinations are held every January and June during the 4 years comprising the course of studies.

These examinations are very thorough and require from the cadet a close and persevering attention to study, without evasion or slighting of any part of the course, relaxations of any kind can be made by the examiners.

tary instruction.—From the termination of the examination in June to the end gust the cadets live in camp, engaged only in military duties and exercises and ir[illegible]l military instruction.

Except in extreme cases, cadets are allowed but one leave of absence during the 4 years' course; as a rule the leave is granted at the end of the first 2 years' course of study.

PAY OF CADETS.

The pay of a cadet is $540 per year, to commence with his admission to the Academy, and is sufficient, with proper economy, for his support. No cadet is permitted to receive money or any other supplies from his parents or from any person whomsoever without the sanction of the Superintendent.

Cadets are required to wear the prescribed uniform. All articles of their clothing are of a uniform pattern and are sold to cadets at West Point at regulated prices.

EXPENSES OF CADETS PRIOR TO ADMISSION.

The expenses of a candidate for board, washing, lights, etc., after he has reported and prior to admission will be about $10. Immediately after being admitted to the institution he must be provided with an outfit of uniform, the cost of which will be about $90, making a total sum of $100, which must be deposited with the treasurer of the Academy before the candidate is admitted. It is best for a candidate to take with him no more money than will defray his traveling expenses and for the parent or guardian to send to "The Treasurer, U. S. Military Academy," the required deposit of $100. Any deviation from the rule as to the amount or manner of making the deposit must be explained in writing by the parent or guardian of the candidate to the Superintendent of the Academy.

ASSIGNMENT TO CORPS AFTER GRADUATION.

When any cadet of the United States Military Academy has gone through all its classes and received a regular diploma from the academic staff, he may be promoted and commissioned as a second lieutenant in any arm or corps of the Army in which there may be a vacancy and the duties of which he may have been judged competent to perform; and in case there shall not at the time be a vacancy in such arm or corps, he may, at the discretion of the President, be promoted and commissioned in it as an additional second lieutenant, with the usual pay and allowances of a second lieutenant, until a vacancy shall happen.

GENERAL QUALIFICATIONS.

A sound body and constitution, suitable preparation, good natural capacity, and aptitude for study, industrious habits, perseverance, an obedient and orderly disposition, and a correct moral deportment are such essential qualifications that candidates knowingly deficient in any of these respects should not, as many do, subject themselves and their friends to the chances of future mortification and disappointment by accepting appointments at the Academy and entering upon a career which they can not successfully pursue.

Course of study and books used.

[Books marked thus * are for reference.]

FIRST YEAR—FOURTH CLASS.

Department.	Course of study, text-books, and books of reference.
Mathematics	Davies's Elements of Algebra, Davies's Legendre's Geometry, Ludlow's Elements of Trigonometry, Davies's Surveying, Church's Analytical Geometry.
Modern languages	Keetels's Analytical and Practical French Grammar, Keetels's Analytical French Reader, *Spiers and Surenne's Dictionary, Whitney's Essentials of English Grammar, Hart's Manual of Rhetoric and Composition, Abbott and Seeley's English Lessons for English People, Abbott's How to Write Clearly, *Webster's Dictionary.
History, geography, and ethics	Lectures in ethics and in universal history.
Tactics of artillery and infantry	Practical instruction in the schools of the soldier, company, and battalion, *Blunt's Rifle and Carbine Firing, practical instruction in artillery.
Use of the sword, etc	Instruction in fencing and bayonet exercise and military gymnastics.

SECOND YEAR.—THIRD CLASS.

Mathematics	Church's Analytical Geometry. Church's Descriptive Geometry, with its application to Spherical Projections. Bass' Introduction to the Differential Calculus. Church's Calculus. Church's Shades, Shadows, and Perspective. Chauvenet's Treatise on the Method of Least Squares.
Modern languages	Keetels' Analytical and Practical French Grammar. Borel's Grammaire Française. Bôcher's College Series of French Plays. Roemer's Cours de Lecture et de Traduction, Vols. I and II. *Spiers' and Surenne's Dictionary.
Drawing	Topography and plotting of Surveys with lead-pencil, pen and ink, and colors; construction of the various problems in Descriptive Geometry, Shades and Shadows, and Linear perspective and Isometric projections; practical surveying in the field. *Reed's Topographical Drawing and Sketching, including Photography applied to Surveying.
Tactics of artillery, infantry, and cavalry.	Practical Instruction in the Schools of the Soldier, Company, and Battalion. *Blunt's Rifle and Carbine Firing. Practical Instruction in Artillery and Cavalry.

THIRD YEAR.—SECOND CLASS.

Natural and experimental philosophy.	Michie's Mechanics, 3d Edition. Bartlett's Astronomy. Young's General Astronomy. Michie's Elements of Wave-Motion relating to Sound and Light.
Chemistry, mineralogy, and geology.	Bloxam's Chemistry, 6th Edition. Tillman's Elementary Lessons in Heat (revised edition). Tillman's Essential Principles of Chemistry. Brown's Electric Physiology. Thompson's Elementary Lessons in Electricity and Magnetism. Dana's Manual of Mineralogy and Petrography, 5th edition. Le Conte's Elements of Geology.
Drawing	Free Hand Drawing and Landscape in black and white. Constructive and Architectural Drawing in ink and colors. *Reed's Topographical Drawing and Sketching.

Course of study and books used—Continued.

[Books marked thus * are for reference.]

THIRD YEAR.—SECOND CLASS—Continued.

Department.	Course of study, text-books, and books of reference.
Tactics of artillery, infantry, and cavalry.	United States Army Artillery Tactics. Tidball's Manual of Heavy Artillery Service, U. S. A. United States Army Cavalry Tactics. Upton's United States Army Infantry Tactics. Practical Instruction in the Schools of the Soldier, Company, and Battalion. Practical Instruction in Artillery and Cavalry.
Practical military engineering.....	Practical and Theoretical Instruction in Military Signaling.

FOURTH YEAR.—FIRST CLASS.

Civil and military engineering and science of war.	Wheeler's Civil Engineering. Wheeler's Field Fortifications. Mercur's Mahan's Permanent Fortification, Ed. of 1887. Wheeler's Military Engineering (Siege Operations, and Military Mining). Mercur's Elements of the Art of War. Mahan's Stereotomy. *Royal Engineers, Aide-Mémoire, Parts I and II.
Modern languages.....	Knapp's Spanish Grammar; Knapp's Spanish Readings. *Seoane's Neuman and Barretti's Dictionary.
Law.....	Woolsey's International Law. Cooley's General Principles of Constitutional Law in the United States. Winthrop's Abridgment of Military Law. General Orders No. 100, A. G. O., 1863.
History, geography, and ethics....	Swinton's Outlines of the World's History. Labberton's New Historical Atlas and General History.
Practical military engineering.....	Practical Instruction in the construction of Ponton and Spar Bridges; in the preparation of Siege Materials; and in laying out field and siege works. Practical Instruction in Astronomy, in Surveying, in Military Reconnaissances, in Field Telegraphy: and Night Signalling. *Ernst's Manual of Practical Military Engineering.
Tactics of artillery, infantry, and cavalry.	Practical Instruction in the Schools of the Soldier, Company, and Battalion. Practical Instruction in Artillery and Cavalry.
Ordnance and gunnery.....	Metcalfe's Ordnance and Gunnery. Practical Pyrotechnics. Practical Ballistics.

PRELIMINARY EXAMINATIONS.

The following letter was received from the adjutant of the Military Academy, forwarding a list of questions used at the June examinations:

HEADQUARTERS U. S. MILITARY ACADEMY,
West Point, N. Y., September 15, 1891.

SIR: In accordance with your request of recent date, and with the authority of the Superintendent, I have the honor to forward herewith copies of the lists of questions used at the examination of candidates for admission to the Military Academy in June last.

The lists comprise questions in history of the United States; in the fundamental principles of arithmetic, and especially their application to practical problems; in the rules and principles of English grammar; in geography, particularly that of the United States; in orthography, which also indicates the candidates' ability in writing.

The examination in reading is conducted orally before the entire board, and consists in testing the candidates' ability to read correctly a paregraph or more from some standard school reader, such as "Sargeant's Standard Reader."

A perusal of the lists will show that the examinations, though not very advanced, are thorough, and require from the candidates an intimate acquaintance with the branches indicated.

All lists of examination questions are submitted to the academic board for its examination and approval before being used in the examination of candidates.

Very respectfully,

J. M. CARSON, Jr.,
Second Lieutenant, Fifth Cavalry, Adjutant.

Maj. JOHN M. CARSON,
Secretary of Board of Visitors U. S. Military Academy,
Washington, D. C.

EXAMINATION IN ENGLISH GRAMMAR.

Time allotted, 2½ hours.

DIVISION I.

[N. B.—Write the answers below, numbering them to correspond with the questions.]

1. Name all the *parts of speech.* Which of them are *declined?* Which of them is *conjugated?* Which of them are *not inflected?*

2. What is a *noun?* Name the *kinds* of nouns. How is the *plural* of nouns regularly formed? Write the plural of each of the following nouns: *scarf, wharf, hoof, beauty, mouse, potato, mussulman, story, attorney, brother-in-law, spoonful, Miss Smith, ox, fox.*

3. The three principal parts of the verb *see* are *see, saw, seen*; give the principal parts of the verbs *bid, break, fly, fall, loose, ride, mean, wear, win, shrink, set, steal, lay, freeze, sing.*

4. What is an *adverb?* What is a *conjunction?* What is a *preposition?* What is a *personal pronoun?* Give an example of each properly used in a sentence.

DIVISION II.

N. B.—Write quite across both pages if necessary. Intelligible abbreviations are allowed. In parsing give no rules, declensions, comparisons, or principal parts; but in other respects parse fully, being careful to give the subject of each verb, the governing word of each objective case, and to state precisely what each conjunction connects, between what words each preposition shows the relation, and to what each pronoun refers. Important omissions will be taken to indicate ignorance.

Parse the words in *italics* in the following sentence: *This* nursery *legend* is the *child's version* of those superstitions *which would have strangled* in their cradles the young *sciences now adolescent and able to take care* of themselves, *and which, having been driven* from their nursery, *are watching* with hostile aspect the rapid *growth* of the *comparatively new* science of man.

DIVISION III.

Correct all the errors that occur in the following sentences:

1. Those sort of books were a valuable present.
2. His wisdom, and not his money, produce esteem.
3. Each have their own faults.
4. Who doubts but what two and two are four?
5. He has not, I do not suppose, laid by much.
6. This result, of all others, is most to be dreaded.
7. I have and ever shall insist on the necessity of economy.
   umber of inhabitants were not more than four millions.
   xpressions always sound harshly.
   use, no doubt, is due most of the failures.
   a man whom I thought was the proprietor.
   u take me to be?
   nother arose and expressed their approval.

14. The oldest of the two is about as tall as me.
15. I found it harder than I thought it would have been.
16. He has formerly been a resident of this town.
17. If you would take the trouble to look, you will see it.
18. If I was him, I would be ashamed to go there again.
19. I dare say he is as old if not older than you.
20. I could do it easy enough if every one paid their share.
21. Was it him that argued that the earth was flat?
22. I don't know as the exact cost is known yet.
23. Is there any prospect of the council passing such a by-law.

EXAMINATION IN HISTORY.

Time allowed, 3 hours.

[Write your answer as legibly and concisely as possible without omitting material or important facts.]

1. When was the main land of North America discovered? By whom? Where?
2. What explorations or discoveries did each of the following persons make? Give the date in each case.
   (*a*) Narvaez.
   (*b*) Coronado.
   (*c*) Marquette.
   (*d*) La Salle.
3. Of the thirteen English Colonies which was the first and which the last settled?
4. Name three colonies that were colonized for religious reasons, and name the denomination by which each was colonized.
5. What was meant by charter government, and name two colonies that were at some period under this form of administration?
6. What was meant by "the three lower counties on the Delaware?" What name was given to the territory by its earliest white settlers?
7. What part was taken in Colonial history by each of the following named persons?
   (*a*) Lord Delaware.
   (*b*) Patrick Henry.
   (*c*) John Endicott.
   (*d*) Peter Stuyvesant.
8. Who made the first draft of the Declaration of Independence?
9. Name some important results of each of the following battles of the Revolutionary War:
   (*a*) Long Island.
   (*b*) Trenton.
   (*c*) Brandywine.
10. How many States belonged to the Union when Washington was inaugurated? and name those which had not adopted the Constitution.
11. Give the limiting dates of the war of 1812, and name the cause of that war.
12. When was the city of Washington taken by the British, and what were the circumstances of its capture?
13. During whose administration did each of the following events occur?
   (*a*) Louisiana purchase.
   (*b*) Nullification act.
   (*c*) Gadsden purchase.
14. When and how was the Missouri Compromise virtually repealed?
15. Give three prominent features of the Seminole or Florida War, 1835–'42.
16. What State first passed the Ordinance of Secession? When?
17. Where was the first bloodshed of the Civil War? How was it brought about?
18. Name and give the dates of three prominent events of McClellan's Peninsular Campaign of 1862.

19. Give the date and place of General Lee's surrender.

20. How and in what year was slavery constitutionally abolished in the United States?

EXAMINATION IN ARITHMETIC.

No. 1 [wt. 8]. The sum of two decimal fractions is $\frac{1}{18}$, and one is $\frac{1}{18}$ of the other; find the decimal fractions.

No. 2 [wt. 8]. A vessel contains 5 bu. 3 pk. 2qt. 1pt., how many quarts, beer measure, will it contain?

No. 3 [wt. 8]. Which is the greater, one pound avoirdupois or one pound troy? One ounce avoirdupois or one ounce troy? Show how much in each case.

No. 4 [wt. 11]. $\frac{1}{3}\frac{7}{9}$ is an *erroneous value* of a *required fraction* because its denominator, 39, is too great by $\frac{1}{1}\frac{1}{3}$. Is $\frac{1}{3}\frac{7}{9}$ greater or less than the *true value* of the *required fraction* and how much?

No. 5 [wt. 11]. If 193 versts equal 205.9 kilometres, and 1,552.94 kilometres equal 964.9 miles, how many miles are equal to 100 versts?

No. 6 [wt. 12]. $7\frac{1}{2}$ dozen apples are sold for 6*s*. 2*d*., some are sold at the rate of 3 for $2\frac{1}{2}d$., and the remainder at 8 for $6\frac{1}{2}d$. How many are sold at each rate?

No. 7 [wt. 12]. Two numbers, one of which is 2,685, have for their greatest common divisor 537, and for their least common multiple 18,795; find the other number.

No. 8 [wt. 14]. £925 is so divided among A, B, C, and D, that B's portion is $\frac{1}{2}\frac{1}{2}$ of A's, C's is $\frac{3}{8}$ of B's, and D's is half as much as B's and C's together. What does each receive?

No. 9 [wt. 16]. The grass of 20 acres grows continuously. 133 oxen can eat all of the grass in 13 days (that is the original grass and that which grows in 13 days). 28 oxen could eat 5 acres of the grass in 16 days (that is the original grass and that which grows in 16 days). How many oxen could eat 4 acres of the grass in 14 days (that is 4 acres of grass and that which grows on the 4 acres in 14 days)?

EXAMINATION IN GEOGRAPHY.

Time allowed $2\frac{1}{2}$ *hours.*

1. Name the five oceans of the globe in order of size.

2. Name the seas on the east coast of Asia between Bering Straits and the Straits of Malacca.

3. Name the four most westerly countries of Europe in order from north to south.

4. Upon what river is Vienna situated, what is the direction of its flow below the city, where does it empty?

5. Where is the Isle of Wight? Isle of Man? the Orkney Isles?

6. What two large rivers of Russia empty into the Caspian Sea?

7. Locate definitely the following places: Teheran, Calcutta, Shanghai, and Singapore.

8. Name the Barbary States and the government to which each belongs.

9. Locate definitely the following towns of Africa: Morocco, Tunis, Alexandria, and Mozambique.

10. Name the colonies of Australia. Which is the most eastern, southern, western?

11. Name all the South American countries which touch the Pacific. Give their capitals.

12. Which of the South American countries lie north of the Equator?

13. In what States of Mexico are the following towns: Jalapa, Matamoras, Acapulco, Mazatlan? if upon waters state what.

14. Name the two most southern republics of Central America with their capitals.

15. Name the great lakes on the northern border of the United States in order from east to west. What water ways connect these lakes?

16. What is the most southern point of the United States? Give its latitude.

17. What States touch the Great Lakes? Name them in order from the west to east.

18. Name the States touched by the Missouri River.

19. Name the States east of the Missouri that have neither lake, sea, nor gulf coast line.

20. Bound Virginia, Utah, Missouri, Oregon (mountain and river boundaries not sufficient, all adjacent States must be given).

21. Which is the smallest and which is the largest State in the Union? How do they compare in area?

22. State where the Merrimac River rises, the direction of flow, where does it empty, what town is at its mouth?

23. Locate definitely the following places: Hartford, Little Rock, Montgomery, Milwaukee, Los Angeles.

24. A north and south line through Savannah would pass through what States?

25. Name five towns or cities of the most importance that one would pass in going from Pittsburg, Pa., to Mobile, Ala., by water.

CADETS ADMITTED JUNE, 1891.

The following-named young men passed the preliminary examinations held in June and were admitted to the Academy:

No.	Name.	Where born.	Appointed from—	No.	Name.	Where born.	Appointed from—
1	Akester, Arnold	Ind	Ind.	51	Kelly, William, jr	Tex	Tex.
2	Aldrich, Ward Priest	N. H	N. H.	52	Knowlton, Joseph Lippincott.	Ill	Ill.
3	Allen, Boughton Theodore	N. Y	N. Y.	53	Langdon, Russell Creamer	N. Y	N. Y.
4	Ames, Thales Lucius	Wis	Wis.	54	Letourneau, Oswald	Ill	Ill.
5	Arnold, Conway Hillyer, jr.	N. Y	N. Y.	55	Mayo, Richard Claybrook	Va	Va.
6	Augustin, Joseph Numa, jr.	La	La.	56	McBroom, Walter Scott	Ind	Ind.
7	Beauchamp, Runey Neal	Ky	Ky.	57	McDonald, Thomas Benton	Md	Md.
8	Bell, Ola Walter	Mich	Mich.	58	McGrew, Milton Loomis	D. C	N. J.
9	Bentley, Carle Edwin	Cal	Ark.	59	McIntyre, Thomas Henry Ruger.	Ala	Tenn.
10	Bigelow, Mortimer Osborne.	Mich	Mich.	60	Miles, Perry Lester	Ohio	Ohio.
11	Bolles, Frank Crandall	Ill	Mo.	61	Morrison, John, jr	Iowa	Iowa.
12	Botts, Louis Elkin	Mo	Mo.	62	Myer, George Henderson*	N. Y	N. Y.
13	Briggs, Paul Robert	Mo	Mo.	63	Newbaker, Edward Jay	Pa	Pa.
14	Broatch, James Wallace	S. Dak.	Nebr.	64	Nissen, August Carl	Ohio	Ohio.
15	Brookes, Albert Sidney	Ark	Ark.	65	Nuttman, Louis Meredith	N. J	N. J.
16	Brown, Frank Reid	Miss	N. C.	66	O'Harra, Aloysius Peter Joseph.	Pa	Pa.
17	Bugge, Jens., jr	Wis	Minn.	67	O'Sullivan, Ernest Philip	N. C	N. Y.
18	Burgess, Harry	Miss	Miss.	68	Paine, Charles Herman	Vt	Md.
19	Butler, Clarence Metz	Ohio	Ohio.	69	Parker, James Southard	D. C	Atl'rge
20	Cain, Cornelius Enoch	Ky	Ky.	70	Payne, Brooke	Va	Va.
21	Cavenaugh, Harry La Tourrette.	Utah	Okla.	71	Pearce, Thomas Absalom	N. C	Tex.
22	Champion, Francis Marion	Nebr	Ill.	72	Pritchard, George Barnard, jr.	Ga	Ga.
23	Chapman, Charles Martin	Mo	Mo.	73	Purdy, Clarence Newcomb	Ind	Ind.
24	Charles, Oscar Jerome	Ill	Ill.	74	Reisinger, Paul	Pa	Pa.
25	Curtis, Thomas Pelham	Cal	Mass.	75	Ricketts, William Andy	Ill	Ill.
26	Darrah, Thomas Walter	Kans	Kans.	76	Rifenberick, Richard Parker	Ohio	Ohio.
27	Davis, Glenn Hedges	Ohio	Ohio.	77	Sample, Warren Stone	Tenn	Ky.
28	Delaney, Daniel	Cal	Cal.	78	Schulz, Edward Hugh	W. Va	W. Va.
29	Dennis, Samuel	Mo	Mo.	79	Shelton, George Henry	Conn	Conn.
30	Dickason, Denis Henry	Pa	Colo.	80	Sills, William Gray	Ala	N. C.
31	Dillaway, Alvan Simonds	Mass	Mass.	81	Siviter, Francis Pierpont	Pa	Pa.
32	Dixon, Henry Benjamin	Iowa	Iowa.	82	Smith, Fine Wilson	Ky	Ky.
33	Duff, Clyde Lemont	Ill	N. D.	83	Smith, Harry Ernest	Me	Minn.
34	Duncan, Daniel	Ky	Ky.	84	Smith, Morton Fitz	Colo	Mich.
35	Durkin, Joseph Francis	Irel'd	N. Y.	85	Springer, Anton, jr	France	N. Y.
36	Dwyer, James Charles	Ind	Iowa.	86	Steigmeyer, Frederick Franklin.	Ohio	Ohio.
37	Dwyer, Thomas Francis	Irel'd	N. Y.	87	Stout, Harry Howard	Ariz	Pa.
38	Eltinge, Le Roy	N. Y	N. Y.	88	Sturtevant, Girard	N. Y	N. Y.
39	Fergusson, Frank Kerby	Tenn	Tenn.	89	Sweeney, Thomas Maurice	Va	Va.
40	Fleming, Adrian Sebastian	Ky	Ky.	90	Turman, Reuben Smith	Miss	Miss.
41	Gold, Edward Barnett	Va	Va.	91	Vincent, James Irving	Mich	Mich.
42	Gurney, John Asa	Mich	Mich.	92	Watson, Frank Bingly	Va	N. J.
43	Hammatt, William Cushing.	Me	Me.	93	Wheeler, Joseph, jr	Ala	Ala.
44	Hampton, Celwyn Emerson.	Ohio	Ohio.	94	White, Herbert Arthur	Iowa	Iowa.
45	Hartshorne, Benjamin Minturn, jr.	N. J	N. J.	95	Whitesides, John Garrett	Pa	Pa.
46	Hawkins, Clyde Emile	Pa	Pa.	96	Willoughby, Charles Russell	Cal	Cal.
47	Hayes, Fitzhugh Lee	N. C	N. C.	97	Wright, Robert John	Wis	Wis.
48	Herron, Joseph Sutherland.	Ohio	Ohio.				
49	Howland, Charles Roscoe	Ohio	Ohio.				
50	Hutton, Franklin Swart	N. Y	N. Y.				

*Admitted September 1.

VACANCIES IN THE CADET CORPS FOR JUNE, 1892.

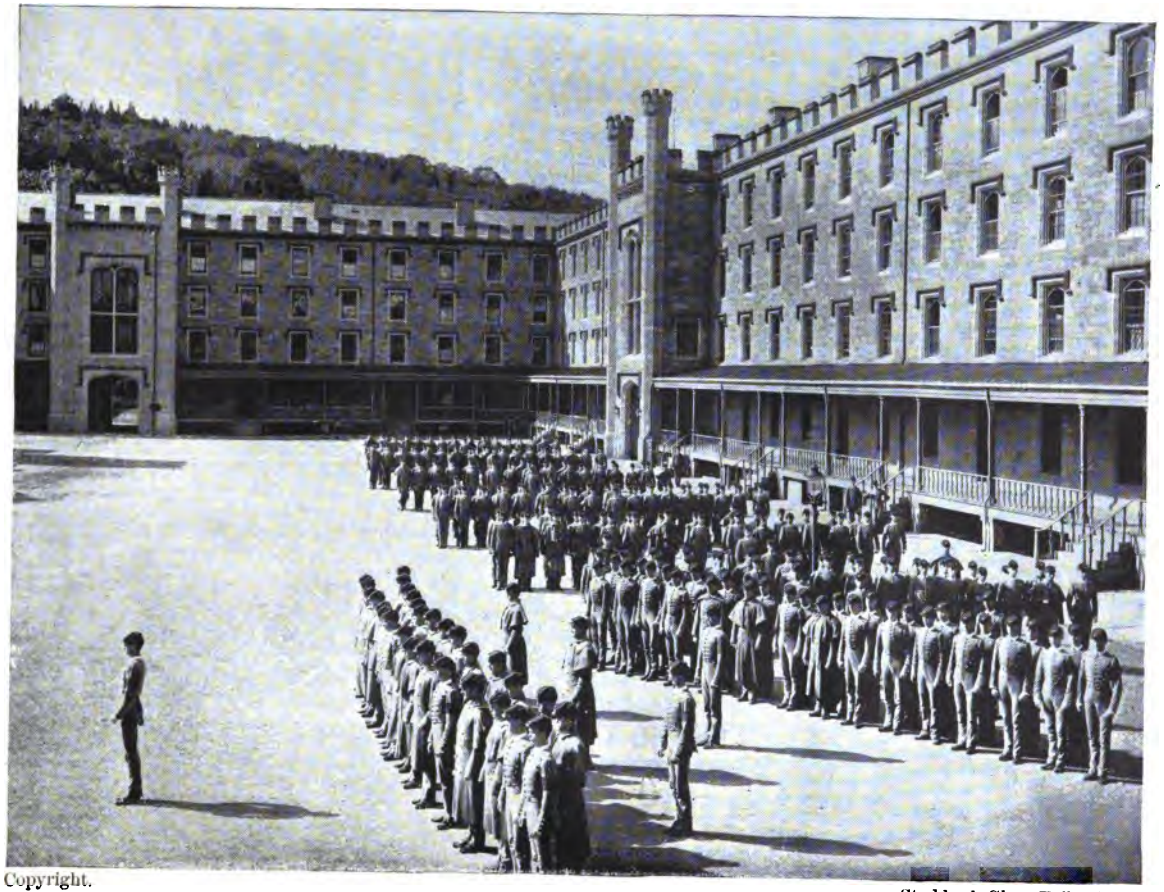
The tables given below show the districts in which vacancies now exist and those in which vacancies will exist in June next upon the graduation of the present first class. The lists were obtained from the War Department on October 3, and the asterisk (*) indicates those districts for which appointments were made up to that date. The first table shows the vacancies in the Cadet Corps on September 1, 1891. These number 70. It must be apparent to all who will give the subject the briefest consideration that a system of appointments under which so large a number of districts can be left unprovided for is sadly defective, and that some remedy is imperatively demanded to correct this large waste. It must not be forgotten that all these vacancies belong to the class which entered in June, 1891, and that at least 75 per cent. of them would have been avoided had members of Congress properly and promptly exercised the privilege bestowed upon them of nominating candidates.

The second table shows the vacancies which will exist by reason of the graduation of the present first class. These number 58, and in addition to these there will be four vacancies "at large" which the President has nominated candidates to fill. With the 70 vacancies that belong to the class which entered in June, 1891, there will be in June, 1892, 132 vacancies to be filled, and this number is pretty certain to be augmented by at least 20 casualties that will occur during the present academic year.

Congressional Districts unrepresented at the Academy September 1, 1891.

State.	District.	State.	District.
Arkansas	Second.*	New York	First.*
Do	Third.*	Do	Nineteenth.
Colorado	———.	Do	Twenty-sixth.
Georgia	Third.*	Do	Thirtieth.*
Illinois	Tenth.	Do	Thirty-first.*
Do	Eleventh.	North Carolina	Fifth.
Do	Twelfth.	Ohio	Sixth.*
Do	Eighteenth.	Do	Eleventh.*
Do	Nineteenth.	Do	Thirteenth.*
Indiana	First.*	Do	Fourteenth.*
Do	Third.*	Do	Fifteenth.*
Iowa	First.*	Do	Sixteenth.*
Kansas	Second.*	Do	Seventeenth.*
Do	Sixth.	Pennsylvania	Second.*
Do	Seventh.*	Do	Eighth.*
Kentucky	Sixth.*	Do	Eleventh.
Do	Eighth.	Do	Twelfth.
Do	Tenth.*	Do	Fifteenth.
Louisiana	Second.*	Do	Sixteenth.*
Do	Fifth.	South Carolina	Fifth.
Maryland	Second.	Tennessee	Ninth.
Do	Fifth.	Do	Tenth.*
Massachusetts	Seventh.	Texas	First.*
Michigan	First.	Do	Second.
Do	Second.*	Do	Fourth.
Minnesota	First.*	Do	Fifth.
Do	Third.*	Do	Tenth.*
Mississippi	Second.	Virginia	Tenth.
Do	Sixth.	West Virginia	Second.
Do	Seventh.	Do	Third.
Missouri	First.	Do	Fourth.
Do	Third.	Wisconsin	Fifth.*
Do	Twelfth.*	Do	Sixth.*
Nebraska	Third.*	Do	Seventh.
New Jersey	Fourth.	Do	Ninth.*

*Districts from which candidates have been selected for June, 1892.



Copyright. Stoddard, Glens Falls, N. Y.

CADETS MARCHING TO DINNER.

Congressional Districts to be vacant by the graduating class of June, 1892.

State.	District.	State.	District.
Alabama	Fifth.	New Jersey	Seventh.*
Do	Seventh.*	New York	Sixteenth.*
Arizona Territory	———.*	Do	Eighteenth.*
Arkansas	Fifth.*	Do	Twenty-first.*
Florida	First.*	Do	Twenty-ninth.*
Do	Second.	North Carolina	Sixth.*
Georgia	Fifth.*	Ohio	First.*
Do	Sixth.*	Pennsylvania	Fourth.*
Do	Seventh.*	Do	Sixth.*
Illinois	Fourteenth.*	Do	Tenth.*
Indiana	Seventh.*	Do	Fourteenth.*
Iowa	Seventh.*	Do	Twentieth.*
Do	Ninth.*	Do	Twenty-fifth.*
Do	Tenth.*	Do	Twenty-eighth.*
Kansas	Fourth.*	South Carolina	First.*
Do	Fifth.*	Do	Second.*
Kentucky	Second.*	Do	Fourth.*
Louisiana	Sixth.*	Tennessee	First.*
Maine	Second.	Do	Second.*
Massachusetts	First.*	Do	Fifth.*
Do	Second.*	Do	Sixth.*
Michigan	Eleventh.	Texas	Sixth.*
Missouri	Fifth.*	Vermont	First.*
Do	Sixth.*	Do	Second.
Do	Eighth.	Virginia	Second.*
Do	Thirteenth.*	Washington	———.*
New Hampshire	First.*	Wisconsin	Second.*

* Districts from which candidates have been selected for June, 1892.

MILITARY AND ACADEMIC STAFF.

The officers on duty in June, 1891, at the Military Academy, in the several departments, was as follows:

SUPERINTENDENT.

Colonel JOHN M. WILSON, *Colonel of Engineers.*

MILITARY STAFF.

Second Lieut. JOHN M. CARSON, Jr., Fifth Cavalry, Adjutant of the Military Academy, Post Adjutant, and Recruiting Officer.

Capt. WILLIAM F. SPURGIN, Twenty-first Infantry, Treasurer of the Military Academy and Quartermaster and Commissary of Cadets.

Capt. WILLIAM H. MILLER, Assistant Quartermaster, U. S. A., Quartermaster of the Military Academy, Post Quartermaster, and Disbursing Officer.

First Lieut. DANIEL H. BOUGHTON, Third Cavalry, Officer of Police, Post Commissary of Subsistence, Post Treasurer, and Assistant to Post Quartermaster.

Maj. HENRY MCELDERRY, Surgeon, U. S. A., Post Surgeon.

Capt. WM. FITZHUGH CARTER, Assistant Surgeon, U. S. A.

Acting Assistant Surgeon WILLIAM P. COMPTON, U. S. A.

ACADEMIC STAFF.

[Professors whose service at the Academy as professor exceeds 10 years have the assimilated rank of colonel, and all other professors the assimilated rank of lieutenant-colonel.]

Department of Natural and Experimental Philosophy.

PETER S. MICHIE, Professor (14th Feb., 1871).

First Lieut. Sedgwick Pratt, Third Artillery, Assistant Professor.

First Lieut. James S. Pettit, First Infantry, First Lieut. John B. Bellinger, Fifth Cavalry, Instructors.

First Lieut. Frank S. Harlow, First Artillery, in charge of Observatory and Astronomical Observations.

Department of Modern Languages.

GEORGE L. ANDREWS, Professor (28 Feb., 1871).

Capt. Edward E. Wood, Eighth Cavalry, Assistant Professor of the Spanish Language.

First Lieut. Warren P. Newcomb, Fifth Artillery, Assistant Professor of the French Language.

*First Lieut. Charles H. Hunter, First Artillery; First Lieut. William W. Forsyth, Sixth Cavalry; First Lieut. Benjamin Alford, Twenty-second Infantry; †Second Lieut. Samuel D. Sturgis, First Artillery; * Second Lieut. John E. McMahon, Fourth Artillery, Instructors.

Department of Drawing.

CHARLES W. LARNED, Professor (25 July, 1876).

‡ First Lieut. Hamilton Rowan, Second Artillery, Assistant Professor.

First Lieut. George H. Cameron, Fourth Cavalry; Second Lieut. Cecil Stewart, Third Cavalry; Second Lieut. E. S. Wright, Ninth Cavalry, Instructors.

Department of Mathematics.

EDGAR W. BASS, professor (17 April, 1878).

First Lieut. John A. Lundeen, Fourth Artillery, Assistant Professor.

First Lieut. Wright P. Edgerton, Second Artillery; First Lieut. Charles R. Noyes, Ninth Infantry; ‡ First Lieut. Harry C. Benson, Fourth Cavalry; First Lieut. George F. Barney, Second Artillery; ‡ First Lieut. Alfred B. Jackson, Ninth Cavalry; ‡ First Lieut. Samuel D. Freeman, Tenth Cavalry; Second Lieut. Frank McIntyre, Nineteenth Infantry, Instructors.

Department of Chemistry, Mineralogy, and Geology.

SAMUEL E. TILLMAN, professor (21 December, 1880).

First Lieut. John P. Wisser, First Artillery, Assistant Professor.

* First Lieut. Erasmus M. Weaver, jr., Second Artillery; Second Lieut. Elmer W. Hubbard, First Artillery; Second Lieut. Harry Freeland, Third Infantry, Instructors.

Department of History, Geography, and Ethics.

WILLIAM M. POSTLETHWAITE, Chaplain, Professor (21 December, 1881).

First Lieut. Frank L. Dodds, Ninth Infantry, Assistant Professor.

First Lieut. Francis J. Kernan, Twenty-first Infantry, Instructor.

Department of Civil and Military Engineering.

JAMES MERCUR, professor (29 September, 1884).

First Lieut. Harry F. Hodges, Corps of Engineers, Assistant Professor.

First Lieut. Lansing H. Beach, Corps of Engineers; First Lieut. Joseph E. Kuhn, Corps of Engineers, Instructors.

---

* Relieved from duty at the Military Academy June 15, 1891.
ved from duty at the Military Academy August 28, 1891.
ved from duty at the Military Academy August 8, 1891.

Department of Tactics.

Lieut. Col. HAMILTON S. HAWKINS, Twenty-third Infantry, Commandant of Cadets and Instructor of Tactics. (1 Feb., 1888.)

Capt. Louis A. Craig, Sixth Cavalry, Senior Assistant Instructor of Cavalry Tactics.

First Lieut. John D. C. Hoskins, Third Artillery, Senior Assistant Instructor of Artillery Tactics.

First Lieut. Edward E. Hardin, Seventh Infantry, Senior Assistant Instructor of Infantry Tactics, commanding Band and Detachment of Field Music.

*First Lieut. William W. Galbraith, Fifth Artillery, Assistant Instructor of Tactics, commanding Company of Cadets.

*First Lieut. John A. Johnston, Eighth Cavalry, Assistant Instructor of Tactics, commanding Company of Cadets.

First Lieut. Daniel L. Tate, Third Cavalry, Assistant Instructor of Tactics, commanding Company of Cadets.

Second Lieut. Robert A. Brown, Fourth Cavalry, Assistant Instructor of Cavalry Tactics.

Second Lieut. T. Bentley Mott, First Artillery, Assistant Instructor of Tactics, commanding Company of Cadets.

Department of Law.

JOHN W. CLOUS, Major and Judge Advocate, U. S. A., Professor (28 Aug., 1890, by assignment under act of 6 June, 1874).

First Lieut. Frank L. Dodds, Ninth Infantry, First Lieut. Francis J. Kernan, Twenty-first Infantry, Instructors.

Department of Ordnance and Gunnery.

†Capt. HENRY METCALFE, Ordnance Department, Instructor (28 Aug., 1886).

First Lieut. Edwin B. Babbitt, Ordnance Department, First Lieut. John C. W. Brooks, Fourth Artillery, Assistant Instructors.

Department of Practical Military Engineering.

Capt. GEORGE McC. DERBY, Corps of Engineers, Instructor (4 Jan., 1889).

First Lieut. Eugene W. Van C. Lucas, Corps of Engineers, Second Lieut. Charles H. McKinstry, Corps of Engineers, Assistant Instructors.

HERMAN J. KOEHLER, Master of the Sword.

ARTHUR A. CLAPPÉ, Teacher of Music.

---

* Relieved from duty at the Military Academy August 29, 1891.
† Relieved from duty at the Military Academy August 8, 1891.

CONCLUSION.

The Board earnestly commends the Military Academy to the fostering care of Congress and the liberal support of the people. It is the only national military school we have, and nothing should be left undone to maintain its high character, promote its efficiency, and increase its usefulness. National pride, regard for the common defense, and sound public policy require that its equipment should be thorough, and that the highest patriotism and best talent should continue to characterize its direction. Its graduates in the past have met every requirement of the public service, and there can be no manner of doubt that should occasion arise West Point will in the future fully meet the expectations of the American people. No consideration of economy should be permitted to thwart or delay the furnishing of proper supplies and equipment so urgently needed to place the Military Academy abreast of similar institutions in other countries.

The deficiencies in proper equipment now so manifestly apparent should be corrected without delay by Congress. Considering these deficiencies, which have been pointed out in this report, it is surprising that those charged with the immediate direction of the Academy have accomplished, and are still accomplishing, such remarkable results. Even with the existence of deficiencies in equipment, our Military Academy does not materially suffer by comparison with similar schools of Europe. If we compare the advantages of West Point with other military establishments it will be seen how much wider and broader are our systems of military education. In England there is one school devoted alone to training officers for the staff, and although much of the education is devoted to field work and out-door duties, military history and languages receive close attention, and in addition, as in our Academy, special care is given to the sciences, and especially practical astronomy.

The value of astronomy alone as a potent adjunct in military warfare was seen in Egypt, when the regiments of Lord Wolseley made a night attack on the Arabs, and went into action by the guidance of the stars. The stars marked the line of advance and the position of regiments, and in here the skies are generally cloudless, and the stars aspects of nature as are manifest at so many points stronomy becomes as important as at sea. There school of apparently a lower grade, for the training

of officers in cavalry and infantry, and where the tuition embraces the elementary principles of military art. The Woolwich Academy, perhaps the best known, prepares officers for the artillery and the engineers. Here the scholars are expected to spend three years, and when graduation comes, the cadets with the higher averages, like our own, can have an option on the engineers.

For a cadet to pass either through one school or the other and afterwards take staff duty, involves an additional course of two years. So that a subaltern in the British army can hardly hold himself as equipped for duty without an educational training of five or six years. In these schools, however, the standard has steadily advanced. Critics who complain of the higher grades established at West Point, and the apparent hardships attending an entrance to the Army, forget that there has been a steady progress in the art of war—that war is a progressive art—and that even the elementary problems are not under present conditions, as was possible in ruder times, to be passed without a certain maturity of mind.

The days when regimental colors were given to boys of 13, when even as famous a general as Marlborough was promoted from court page to the Guards at 16, and Wellington was made an ensign at 17, have passed away. The very eminence that Marlborough and Wellington attained in the military art would have had added value if either of them had taken the colors with as complete an academic education as Napoleon, Grant, Moltke, Sherman, Wolseley, and commanders of equal fame. Not alone as masters of the art of war, but in the civil functions which so often devolve upon the modern soldier, this academic education such as Napoleon enjoyed, and as we have in better form at West Point, must have great value. The just criticisms of history upon the civic careers of Marlborough and Wellington; the incredible mistakes of Wellington, especially in keeping out of tone and temper with the English people when he was in the cabinet and prime minister, would have been impossible to the soldier, however brilliant as a tactician, whose mind had been formed upon the sound academic principles of our Military Academy.

In these later years when we train soldiers it should be remembered that the art to be a soldier is only the first step in the art of being a statesman. And nothing, we think, redounds more to the glory of the Academy than the fact that so many of her alumni hold so proud a position in the civil annals of their country.

The Army is the disciplined force of the nation. It is the expression of national power. As no chain is stronger than its weakest link, so no nation is stronger than the organized military embodiment of its strength. Now, if we accept this as an axiom, one which, unhappily or otherwise, has been imposed upon us by modern civilization, then it is the first duty of the lawgiver to see that the sword of the nation is even-tempered and true. There are various examples. If we look at Eng'

we have an army which is a class. It stands apart from the nation. When there is the canker of a long peace it is apt to disintegrate or suppurate into mutiny.

Not many months since a regiment of the Guards bearing one of the illustrious names in the British service was sent into exile because it would not obey its officers. The mutiny, however, was not really against military duty, but against the enervation of London life, barrack luxuries in Knightsbridge, and a system of command which severed the men from any actual contact with their commanders; which permitted officers to dawdle around clubs and drawing rooms; and, keeping out of touch with their men, remanded them to noncommissioned officers for whom the men had no respect, and who were incapable of intelligent authority. Such a mutiny would have been impossible in an American regiment under graduates of West Point. Every American officer is in sympathy, in contact with his command. To this extent, therefore, the West Point training does away with the evil of the Army becoming a class, the evil which English critics appreciate and deplore.

This English system of isolation is only possible in an army whose principal duty is to govern Ireland and police England on occasions of royal ceremony. A large part of the English army is needed to govern India, 75,000 at least of Europeans in that separate command alone, with an unusual percentage of artillery, as would be expected from a military organization whose duty is the defense of garrison towns. As India is practically a nation of garrisons, the military laws governing its army must be narrow and limited, and are hardly worthy of consideration as far as they apply to other systems of military education.

On the continent conditions have found the other extreme. Empires are armies. Under the law of conscription, which the French revolution bequeathed to the monarchies, the military aspect changed, and it seems as if continental nations were returning to the nomadic methods of warfare which made possible the invasions of Genghis Khan and Timour. Conscription was the source of the extraordinary battalions of Napoleon, and made it possible for him to lose an army in the snows of Russia in one year and take another from the fields and vineyards of France for the year ensuing. Germany was better served in her own method of thorough discipline. Reduced as Prussia was, during Napoleonic wars, to the necessity of maintaining a small standing army, —not quite 50,000—the Germans kept constantly changing their men as soon as drilled. The army in the field was, therefore, simply one of recruits. At home in peaceful employments, but waiting the sound of the drum, was an ever increasing army of well-trained men.

This short-service system, as a contrast to the long term which prevails in England—and that of desertion and pardon, which may be summed up as the existing condition of the American Army—compelled the establishment in Germany of high-class schools for military education. And

although the German system became more like the French after the war with Austria in 1866, and conscription has become as fixed under the German Emperor as under Danton and the French revolution, it was necessary that the German army should be strong at the top. Armies might come and go; one generation would tread on the heels of another; the front ranks would soon fall out, if not before the bullet of the enemy before the surer and steadier fire of advancing years; but there must be a permanent, highly trained head, and especially a staff which should be as perfect in its workings as the most cunning inventions devised by the mechanical genius of man.

We find in this staff system the highest form of military attainment toward a perfect knowledge of the art of war. Moltke's military genius reduced to a Euclid problem is its supreme type. The nearer therefore we approach its severe and thorough standards in our Academy the better the ultimate value to the nation, should war come with its stern supreme commands. No amount of intelligence, natural aptness, ability in active peaceful business or industrial callings, will take the place of this finished and exacting education. The unarmed nation is the surprised nation. No high development of art and genius can resist the sword. Look at countries like India, Egypt, the Roman Empire, before the northern invasion, the Chinese Empire. How admirable their development! What art! what literature! What have they not done for man? There is no day, no hour, when we may not feel an obligation to them. In the finer forms of civilization, in poetry, literature, morals, and exquisite achievements of patience and artistic fancy, how much we may learn from them. Yet, because they neglected the one art of all in which everything is embodied, honor, safety, prowess, national pride, and the very integrity of religion and home; because the art of self-protection was permitted to drift into abeyance, they became the prey of ravaging tribes and conquering nations. The dagger in the hands of a Vandal was mightier than the verses of Homer and Virgil, while the sword in the hands of an Englishman was a power greater than the luxurious civilization of generations of Mogul princes.

What these highly developed and refined nations never learned, we should not forget to learn, until like them, it may be too late. There is no civilization stronger than its capacity for self-defense. Its capacity for self-defense can only be measured by the standards of its highest military education. It should be the aim of those who govern our Military Academy to advance towards an ever ascending, ever maturing ideal. They should remember that the science of war changes with the generations; that every new force in nature will in time be a new force in war; that the telegraph would have made the surprise of Austerlitz impossible; that the telephone would have brought Grouchy to Waterloo in time to have saved the battle for Napoleon.

We must remember that science and discovery have not come to a standstill, that these forces will grow as they have grown, and that the

surest military faculty is that which is instant to search them out and apply them. With trained men to lead the nation, there need be no fear of what the people will do in the day of peril. It has been the high privilege of West Point to give the nation such leaders, and their renown now illumines the noblest pages in our country's annals. Let us so guard and strengthen the venerable Academy that, with other trials, other soldiers will come from its halls ready to defend the Republic and add new luster to the glory which, as a proud heritage of West Point, surrounds the names of Thomas and Sheridan, Sherman and Grant.

CHAS. F. MANDERSON.
SAML. W. T. LANHAM.
JOHN M. CARSON.
FRANK A. O'BRIEN.
JAMES T. MURFEE.
JAMES A. WAYMIRE.
DAVID W. PAYNE.
THEODORE S. PECK.
ROBERT O. FULLER.
JAMES L. PUGH.
JULIUS C. BURROWS.
JOSEPH A. SCRANTON.

UNIVERSITY OF MICHIGAN
3 9015 02676 5894